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FOR THE

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MARCH, 1848.

CIVIL ENGINEERING.

Report of the Board of Managers to the Stockholders of the Mine-Hill and Schuylkill Haven Railroad Company, at their Annual Meeting, January 10th, 1848.

The Board of Managers of the Mine-Hill and Schuylkill Haven Railroad Company, respectfully present to the Stockholders their annual report.

The year 1847 has been one of great activity, both as respects the current business upon the road, and the extension of facilities for the accommodation of the rapidly expanding trade.

The net tonnage, as shown by the Collector's returns, amounts to five hundred and eighty-three thousand five hundred and ninety tons 13-20; being nearly one hundred and eighteen thousand tons, or 25 per cent. greater than that of the year immediately preceding.

The total tonnage that has passed the Company's scales, is three millions seven hundred and six thousand eight hundred and fifty-seven tons; of which two hundred and forty-one thousand and fifty-two tons, have passed over the road free of toll, under an allowance made to the operators in the shape of a deduction from the gross weight.

The improvements of a permanent character, completed during the year, have been—the extension of the road from Schæffer's creek, on the West Branch, to the town of Tremont, in the valley of the Swatara, a distance of seven and a quarter miles; and the reconstruction of a considerable portion of the road, to fit it for the introduction of

locomotive engines, under the provisions of the supplement to the charter, passed on the 9th of March last. Both of these improvements have been attended with greater labor and expense than was anticipated previously to their commencement. The preparation of the road for the engines, involved the necessity of relaying with a heavy edge rail, weighing sixty pounds to the yard, one track upon the entire length of the main road, and several miles upon the branches.

In many places new grading was required for obtaining the requisite width between the tracks, and at other points it was necessary to make an entire change of location, to avoid curves that were deemed impracticable for locomotive engines. The bridges were thought to be of insufficient strength, and as they were likewise too narrow to admit of increasing the width between the tracks, the greater number of them were removed—although many had been newly erected only a year ago—and were replaced by new structures of sufficient strength and width. In some instances, the piers and abutments were rebuilt in a more substantial manner, and the retaining walls of many of the embankments have also been renewed.

In addition to these important improvements on the road, a large amount of entirely new work has been executed, in providing water stations and wood depots, at several points, and in the construction of a large building of a substantial and permanent character, for the accommodation of the engines, which has been erected on a convenient site, recently bought for that purpose. The difficulty and expense of executing these works were much increased by the necessity for carrying them on concurrently with the large trade upon the road, amounting to several thousand tons per day; passing at all hours, and requiring the track to be kept constantly passable, both for cars and horses. To avoid the hazard of serious accidents, it was deemed best to interrupt the transportation temporarily, for the reconstruction of several of the larger bridges, on the lower part of the road: accordingly, when the preparations were sufficiently advanced, due notice was given to the operators, and a suspension of trade for four days, occurred in the month of July. The introduction of the engines was precipitated, before the arrangements were completed, by the restlessness of the teamsters engaged in hauling upon the road, who demanded from the operators new contracts, extending to the end of the year, with a large increase of compensation, giving notice to their employers that the teams would be withdrawn on the 14th of August, unless these demands should be complied with.

On the urgent solicitation of the operators, and with a desire to relieve them from this embarrassment, the Board consented to commence running the engines upon the lower part of the road, at the period thus designated by the teamsters; such of the engines as were ready were accordingly placed upon the road, and have continued in use, gradually extending their trips as the needful preparation of the road progressed, until they have reached the extremities of three of the branches, and to within a mile of the head of the other two. On one of these they are stopped at a point about a mile below the head,

by a curve of such short radius, as to be impracticable for engines, the removal of which requires the consent of the neighboring land owners, and the co-operation of the Forest Improvement Company, at whose instance, and for whose sole benefit, this portion of the road was located.

On the other branch, the switches of the operators have not yet been prepared for the safe use of the engines.

As soon as these impediments shall have been removed, their trips will be extended to the extremities of all the branches.

Upon the important practical questions relative to the class of engines best adapted to the character of the road, and the number requisite for carrying the trade, an engineer of extensive experience was consulted; and in accordance with his advice, the Board contracted for six engines, weighing from fifteen to seventeen tons; three from the manufactory of M. W. Baldwin, and three from that of Norris Brothers. Owing to delay in the delivery of some of the engines beyond contract time, the motive power in possession of the Company was not sufficient for the trade at the time appointed for the withdrawal of the teams; but the deficiency was supplied by the President of the Philadelphia, Pottsville, and Reading Railroad Company, who obligingly offered the use of some of their engines, until our own were received.

The number of engines contracted for, was supposed to be sufficient for carrying not only all the trade upon the old road and its branches, but also for that of the new road to Tremont, then nearly completed. This expectation would have been realized, if due regularity in the arrival of the empty cars at Schuylkill Haven could have been attained; but owing to the great irregularity of the supply of cars, the whole force was required for the trade on the old road, and it became necessary to secure a seventh engine for the exigency of the Tremont trade. This is of a heavier class than the others, weighing about nineteen tons, with eight driving wheels, all connected: it has been used partly on the new road, and partly on the older branches.

In view of the probable increase of the trade, and gradual deterioration of the engines, it has been deemed proper to make provision of three more, to be placed on the road in the ensuing spring; making in the whole, ten engines, of a class adapted for heavy freight, which it is believed will be an ample force for any amount of trade that may reasonably be anticipated.

In addition to the purchase of iron rails, amounting to one thousand tons, reported last year, the greater part of which were designed for the new road, a further supply became necessary for the adaptation of the road for the new motive power; and a contract was accordingly made with the proprietors of the Phœnixville Works for six hundred tons, a portion of which, amounting to three hundred and thirty-eight tons, has been received and laid upon the road, and the remainder will probably be delivered early in the spring, and will be laid without delay; completing the line of heavy rails upon all the branches, but about two and a half miles, requiring about two hundred and fifty tons more of the same kind of rail. The series of per-

manent improvements will be completed, so far as is at present contemplated, by the enlargement of the engine house for the reception of the additional engines, and the erection of a machine shop, properly stocked with tools and machinery, for the repair of the engines and other apparatus connected with their use.

The road, with its branches, will then embrace about nineteen miles of double track, and eight miles of single track, laid with heavy edge rails, and provided with all the necessary stations for water and wood; substantial buildings and machinery for housing and repairing engines, and sufficient motive power for a trade of eight hundred thousand tons per annum.

These multifarious and extensive works have not been executed without a corresponding outlay of money; whereby the funds derived from the last increase of the Capital Stock, authorized by law, were exhausted, before the whole was completed. To provide the requisite means beyond the capital subscribed, a loan has been contracted under the authority conferred on the Board, at the special meeting of the Stockholders, convened on the seventh of October last, to the amount of one hundred and twenty thousand dollars; being part of a loan of two hundred thousand dollars, bearing interest at the rate of six per cent. per annum, which is to be secured by a mortgage of the fixed property of the Company, executed to trustees chosen at the same meeting. The loan has been taken by the Stockholders at par; an instalment of forty thousand dollars has been paid in, of which twenty thousand dollars have been appropriated to the payment of a prior loan of the same amount, for the extinguishment of the mortgage by which it was secured; and the remainder has been applied to the liquidation of the expenses incurred in the improvement and extension of the road and its appurtenances, to which purpose the future instalments will also be devoted.

The supplement to the Company's charter, authorizing the last increase of the Capital Stock, embraced a clause, requiring a reduction of the tolls from two to one and a half cents a ton a mile, to take effect after the 27th of March, then next ensuing. By a resolution of the Board, the reduction took place on the *first* of March last, and has resulted in a diminution of the receipts for tolls, which partly neutralizes the effect of the large increase of transportation; and diminishes the last half yearly dividend to seven per cent., being one per cent. below the limit prescribed by the charter.

The anticipated increase of the trade in the current year will, it is believed, be sufficient to restore the dividend to its legal limit, and leave a surplus to be applied to the restoration of the depreciation fund, on which large drafts have been made by the extraordinary repairs of the last two years; and also for the institution of a sinking fund for the redemption of the recent loan.

The completion of the new road to Tremont was delayed, by circumstances beyond the control of the Board, to so late a period of the business season, as to allow but little opportunity of testing the capacity of that region, to fulfil the promise of furnishing a remunerating trade; but so far as a judgment may be pronounced, the indications are of a favorable character.

Among the numerous objects which have claimed the attention of the Board, there are two having especial claim, by reason of their important influence upon the economical use of locomotive power. These are, the introduction of anthracite as fuel for the engines; and the framing of a system of regulations for the government of the speed, and general management of the transit on the road, whereby the liability to accidents, involving serious hazard of human life, and interruption of business, may be reduced to its lowest practicable limit. The latter of these objects, it is hoped, may be attained, by gradually digesting a scheme of regulations, based upon daily experience, and adapted to the peculiarities of the road and its trade.

The experiment of using coal has been attempted in one of the engines, and although the results may not be considered to have been as yet fully developed, they are sufficiently encouraging to warrant a similar trial in the three new engines now about to be contracted for.

The amount of the receipts and disbursements for the year, is exhibited in the abstract of the Treasurer's Report hereto appended.

On behalf of the Board of Managers,

JOHN C. CRESSON, *President.*

Philadelphia, 10*th Jan.*, 1848.

Cutting through the Isthmus of Suez.

The Journal des Debats, discussing the question as to which would be better, a railway or a canal across the Isthmus, says:—"It is proposed by some to overcome the obstacle which now stops the trade and navigation of Europeans, Asiatics, and even Africans, at the Isthmus of Suez, by a railway: by others by a canal. The problem to be solved is: which of the two systems is that which should be adopted? Nature has so disposed it, that all political or commercial communication between the people which form the three continents composing the whole world should take place by sea, consequently that combination which would best serve the maritime interest is that which should be preferred." First, taking the railway project, the Debats goes on to state that between Alexandria, Cairo, and Suez, is a distance of eighty leagues; the execution of a railway along this distance would be easy. With but one line of rails it would cost about 30 or 40 millions of francs, and its working would not cost much, under the dry and preserving climate of Egypt, though it would have to be preserved along parts of its course from the danger of periodical inundations.

"As regards transit, it would carry men and merchandise in about twenty hours from Alexandria to Suez—that is about one-third of the time taken under present circumstances. Compared in the matter of speed to a canal commencing from Peluzium, and having but two locks, one at each end, it would be beaten by steamers, and would gain little, even on sailing vessels. This advantage reduces itself to very little, if it is borne in mind that, for navigation, a great saving in distance would be gained by a canal.

"On the other hand, the inconveniences of a railway are numerous. It does not in the least modify the condition of double transhipment. The existence of such a condition means literally this—complete uncertainty for trade, indeterminate delays, and every chance of a later arrival than if the grand road *via* the Cape had been chosen. Supposing that the isthmus was open by railway, and not by canal, and that a London merchant wished to send merchandise to Bombay or Colombo *via* the Red Sea, he must take the precaution either of sending in advance a vessel from the Cape, or get a vessel freighted in India or at Ceylon, to come to Suez, take in the cargo, and bring it to its destination. This would be simply a piece of extravagance on his part, taking it in a financial point of view, and subject, besides, to risk which nobody would wish to incur. The proof of the impossibility of such an attempt is, that in spite of the perfections to which the service has arrived, nothing arrives in the port of Suez, but the Bombay and Calcutta steamers. A railway would thus be of little use for transit. It would indeed carry men and despatches more conveniently than they are carried at present, but then it would probably not have an increase of either. This is not what is counted upon to create a revenue for a railway, the length of which would extend to 80 leagues.

"Taken as a speculation, the railway does not show itself in a more advantageous light. Experience tells us, passengers and intermediate stations are the great source of profit. It is sufficient to cast a glance over the map of Egypt, to see that from Alexandria to Cairo, two-thirds at least of the distance is uninhabited; and even were a population to exist, such a one would be plunged in abject misery, without trade or industry, without activity, as well as without desire to acquire, because it would know where the fruits of its labor would be taken. Such a population would not be one to appreciate the boon of locomotion. Locomotion is regarded by all people of the East, Chinese, Turks, Hindoos, Arabs, &c., as a malady of our kind. No doubt, an agreeable picture might be formed in imagination, representing the fellahs of Egypt traveling in a railway train; but few, however, have traveled and seen their sad villages, and probed their physical and moral wounds; such a picture would be but a cruel jest. In fine, in a political point of view, one consideration alone should prevent Mehemet Ali from ever giving his consent to the execution of such a project, and for this he need only remember that some years ago the English founded a transit company on his territory, which has since become an object of such constant annoyance to him, that he was obliged to take the matter in his own hand. Yet this administration did not count more than twenty Europeans employed in it. What will not happen, if the Viceroy brings into his country the engineers, stokers, smiths, and all who are necessary for working a railway? Taking all circumstances into consideration, the railway would in reality be but a consecration for the trade of the world of the *status quo:* for Egypt it would introduce into its bosom a dangerous weapon, the explosion of which might take place anywhere but in Cairo and Alexandria."

London Naut. Mag.

Comparative Fares of Railroads in the United States.

As the comparative rates of fare on railroads is a subject of some interest, we avail ourselves of the labors of Mr. Minor, the industrious editor of the American Railroad Journal, as exhibited in the following tabular statement of the principal railroads in the United States, giving their length, through fare, and rate, per mile, from which it will be seen that the New York and Erie Railroad charges the lowest rate, namely, 1·72 cents per mile; the Harlem next, and then the Long Island Railroad. The New England roads all range below three cents, except the New Haven, Hartford, and Springfield, which is one-tenth over. And the next lowest, after the New England roads, is the Weldon and Wilmington, N. C., which is a fraction less than 2½ cents—quite too low for a country so thinly populated, though high enough for many of the more northern lines.

From this statement, it will be seen that the railroads in the State of New York, diverging from the city of New York, charge lower rates than any other roads in the country; and we presume the managers of these roads have been influenced by the belief that, where there is a dense, and, to a certain extent, confined population, the true plan is to put the rates of fare low, and thus induce the masses to use the road. This, we are fully convinced, is the true policy, and we believe it will ultimately prevail.

Name, Commencement, and Termination.	Length. Miles.	Thro' fare Cents. $ cts.	per mile.
Eastern Railroad—Boston to Portland,	105	3 00	2·85
Boston and Maine—Boston to Portland,	110	3 00	2·72
" Lowell—Boston to Lowell,	26	0 65	2·50
" Worcester—Boston to Worcester,	44	1 25	2·80
" Providence—Boston to Providence,	42	1 25	2·97
Fitchburgh—Boston to Baldwinsville,	71	1 75	2·46
Fall River—Boston to Fall River,	53	1 35	2·54
Old Colony—Boston to Plymouth,	37½	1 00	2·66
Western—Worcester to Albany,	156	3 75	2·27
Nashua and Lowell—Lowell and Nashua,	15	0 40	2·66
Concord—Nashua to Concord,	34	0 80	2·35
Norwich and Worcester,	60	1 50	2·50
New Haven and Springfield,	62	1 87	3·00
Bridgeport,	98	2 00	2·04
New York and Harlem,	53	1 00	1·88
New York and Erie,	87	1 50	1·72
Long Island,	95	2 00	2·10
Camden and Amboy—New York to Philadelphia,	90	3 00	3·33
New York and New Brunswick,	33	0 75	2·27
" Philadelphia,	88	4 00	4·54
Reading—Philadelphia and Pottsville,	92	3 00	3·26
Philadelphia and Baltimore,	97	3 00	3·01
Westchester and Columbia,	32	0 75	2·34
Philadelphia, Lancaster, and Harrisburg,	107	4 00	3·73

Name, Commencement, and Termination.	Length. Miles.	Thro' fare. $ cts.	Cents. per mile.
Philadelphia, Germantown, and Norristown,	17	0 40	2·38
Harrisburg, and Chambersburg,	56	2 12	3·78
Baltimore and Ohio—Baltimore to Cumberland,	179	7 00	3·91
" Washington,	40	1 60	4·00
" Susquehanna,	71	2 13	3·00
Washington and Richmond, (including porterage),	133	5 50	4·13
Louisa—Gordonsville,	50	3 25	6·50
Richmond to Petersburg,	22½	1 00	4·34
Winchester and Potomac,	32	2 00	6·25
Petersburgh and Roanoke—Weldon,	63	3 00	4·76
Weldon to Wilmington,	161½	4 00	2·48
Wilmington to Charleston by steamboat,	——	4 00	——
Gaston and Raleigh,	87	4 00	4·60
South Carolina—Charleston to Augusta,	136	6 75	4·96
Columbia—Branchville to Columbia,	68	3 38	4·97
Georgia—Augusta to Atlanta,	171	7 00	4·09
Athens Branch,	39	1 95	5·00
Western and Atlantic—Dalton,	100	5 00	5·00
Central—Savannah to Macon,	191	7 00	3·65
Macon and Western—Atlanta,	101	4 00	3·96
Montgomery and West Point,	60	3 00	5·00
Vicksburgh and Jackson,	47	3 00	6·38
Albany and Schenectady,	17	0 50	2·94
Greenbush and Troy,	6	0 20	3·33
Troy and Schenectady,	20½	0 50	2·43
Utica and Schenectady,	78	3 00	3·84
Utica and Syracuse,	53	2 00	3·77
Syracuse and Auburn,	26	1 00	3·84
Auburn and Rochester,	77	3 00	3·89
Rochester and Attica,	44	1 56	3·54
Attica and Buffalo,	31½	0 94	2·98
Buffalo and Niagara Falls,	22	0 75	3·40
Lockport and Niagara Falls,	24	0 75	3·12
Michigan Central—Detroit to Kalamazoo,	146	4 40	3·00
Detroit and Pontiac,	25	1 00	4·00
Erie and Kalamazoo—Toledo to Adrian,	33	1 00	3·00
Southern Michigan—Monroe to Hillsdale,	70	2 00	2·85
Mad River—Sandusky to Bellefontaine,	102	3 25	3·18
Little Miami—Cincinnati to Springfield,	84	2 00	2·38
Lexington and Ohio,	28	1 25	4·46
Mansfield and Sandusky,	56	1 50	2·67
Madison and Indianapolis,	86	3 00	3·48

It will be found that the railroad companies in the above list adopting the lowest rates of fares, pay the largest dividends. An unanswerable argument in favor of low fares. Hunt's Merch. Mag.

AMERICAN PATENTS.

List of American Patents which issued in the month of November, 1846,—with Exemplifications, by CHARLES M. KELLER, *Engineer and Attorney for Patents, and late Chief Examiner of Patents in the U. S. Patent Office.*

1. For *Improvements in the Drill for Planting Wheat;* Henry W. Smith, Paradise, Pennsylvania, November 4.

The patentee says,—"The nature of my invention consists in so constructing the drill as to raise the teeth when not in use for the purpose of conveying it from place to place, and in forming the seed distributing cylinder in two parts, so that the wheels can be attached directly to the cylinder, while at the same time they have a motion independent of each other—the quantity of the seed to be distributed being regulated by means of a sliding concave attached to the front of the said hopper."

Claim.—"Having thus fully described my improvements, what I claim as my invention, and desire to secure by letters patent, is, first, the employment of a cylinder for seeding, divided into two parts, and directly attached to the wheels, in the manner and for the purpose set forth.

"I also claim elevating the teeth, in the manner and for the purpose specified; and, lastly, I claim gauging the quantity of grain by means of the adjustable concave and wedges, as described."

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2. For *Improvements in Artificial Legs and Feet;* Benjamin F. Palmer, Meredith, New Hampshire, November 4.

We have to omit the claim in this instance, on account of its dependence on the drawings.

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3. For an *Improvement in the Machine for Scraping and Sweeping Chimneys;* James Slaughter, Strasburg, Pennsylvania, November 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the scrapers, brushes, and cars, as constructed and arranged for the purpose set forth."

The scrapers and brushes are attached to spring bars on a polygonal hub, and connected with the whole is a part called the "car or traveling part," which moves from the hub in drawing up the apparatus to draw the spring bars with the scrapers and brushes inwards, to permit the whole to be elevated freely."

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4. For an *Improvement in the Shower Bath;* Horace Wells, Hartford, Connecticut, November 4.

Claim.—"I am aware that boxes for shower baths have been made

similar to the one described before, therefore, I do not claim the box; but what I do claim as my invention, and desire to secure by letters patent, is the pump or pumps worked by treadles in combination with the shower bath or baths, as herein described, or in any manner substantially the same, so that the pump can be worked while the hands are left at liberty."

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5. For *Improvements in Wooden Bridges;* Lowman Gay, Chili, New York, November 4.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of bracing together the upper and lower arch-pieces of the arch trusses, connected together with rods or posts, by connecting the ends of the braces with the arch-pieces at a sufficient distance from the rods or posts, and from each succeeding brace, to cause the parts of the arch-pieces between the ends of the brace to act as levers, to transfer the strain from one brace to another throughout the series, substantially as described.

"And I also claim the method of sustaining the bridge against a lateral thrust, by means of the two inclined trusses connected together at top, substantially as herein described."

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6. For an *Improvement in Printing and Coloring Maps and Prints;* A. D. McKinzie, Philadelphia, Pennsylvania, November 6.

Claim.—"Having thus fully described my invention and its uses, what I claim therein as new, and desire to secure by letters patent, is the combination of a series of sliding tympans, with a corresponding series of plates for printing colors, so that a sheet, when put into the machine, shall receive successively an impression from each plate; the whole forming a vari-colored impression."

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7. For a *Combined Pen and Pencil Case;* Jacob D. Hatcher, Philadelphia, Pennsylvania, November 6.

Claim.—"Having thus fully described my combined pen and pencil case, what I claim therein as new, and desire to secure by letters patent, is the combining the pen-holder in the same case with the pencil-holder, by means of the sliding tubes, combined and operating with the main tube, substantially in the manner herein set forth."

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8. For an *Improved "Reserve for Leads in Pencil Cases;"* Albert G. Bagley, New York, November 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of forming a "reserve" for leads in the outer or revolving cylinder of the machine, by cutting grooves in the periphery of the latter, and covering them with an outer casing of silver or other suitable material, as herein set forth."

9. For a *Machine for Making Sheet Metal Guards for Cap Spinners;* William Cundell, Patterson, New Jersey, November 10.

This invention consists in griping and bending the end of a strip of tin (to form that part of each which makes the connexion with the one next it) on a permanent die, by means of a jointed bender, the faces of which correspond; then bending it over the curved edge of the bender into a semi-cylindrical cavity in the upper part of this bender by a cylindrical die jointed to the stand on the opposite side of the permanent die to which the bender is jointed, and then completing the cylindrical bend over the other portion of the cylindrical die by a hollow segmental former, jointed to the bender above the semi-cylindrical cavity thereof.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of, *first*, the permanent die, the bender, and the cylindrical die, as described; and, *second*, the permanent die, the bender, the cylindrical die, and the segmental former, as herein described."

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10. For an *Improvement in Dry Docks;* Hugh K. Wagner, St. Louis, Mobile, November 10.

This is for a mode of balancing the dock, by means of boxes outside the dock, on the ends of levers, as expressed in the following

Claim.—"I claim the moveable lever, in combination with the dry dock, as the most important and substantial part of my invention and improvement, and disclaim all other parts of the dock hereinbefore mentioned."

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11. For an *Improvement on Tide Water Wheels;* Thomas Rowand, Philadelphia, Pennsylvania, November 10.

Claim.—"I do not claim to have invented the adoption of a gate for turning the water upon the wheels; but what I do claim as my invention, and desire to secure by letters patent, is the construction and adaptation of the two gates in the mode specified, alternating with, and successively acted upon by, the tides, in combination with a wheel, as described, so that either the ebb or flow will find one of the gates, which serves as a guide-water towards the wheel, without changing the direction of motion of the latter."

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12. For an *Improvement in Water Wheels;* Hiram Munger, Chicopee Falls, Massachusetts, November 10.

Claim.—"I am aware that the water has been discharged from a wheel at the bottom near the outside and inside at the same time; but in that case it was discharged downward or fell from the lower edge of the buckets, and through openings in the permanent bottom over which the wheel moves, they (the buckets) being projected beyond the shrouding of the wheel into the shute which lets the water into the wheel.

"But what I claim as my invention, and desire to secure by letters patent, is the employment of a wheel having the shrouding extending out to the periphery of the buckets, which are open inside and outside when combined with a three or more sided flume surrounding it, which flume is provided with a shute on each face to discharge the water into the wheel outside at given distances apart, leaving sufficient room between the shutes for the discharge of the water in tangential lines from the outside of the buckets, substantially as herein described; whereby the water is discharged mainly from the outside of the buckets, when the wheel moves with a velocity equal, or nearly equal, to that of the water by which it is impelled, and mainly inside when it is loaded, and moves much slower than the water by which it is impelled, as described."

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13. For *Improvements in the Turbine Water Wheel;* Theodore R. Timby, Cato Four Corners, Cayuga county, New York, November 10.

Claim.—"I claim making the two rims or flanches that envelope each other so as to constitute the two passages and issues for the water with their inner surface of the gradually decreasing eccentricity, herein described, whereby the water may continue to act on these eccentric surfaces, as its motion from the centre of the wheel is gradually diminished, at the same time gradually decreasing the width of the passages between the flanches inversely, as their length is increased by the increased diameter, as described.

"And I also claim making the outer extremity separate from the rims or flanches, so that they can be removed, and others of different lengths substituted, as described, that the wheel may be adapted to the varying capacity of the column of water."

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14. For an *Improvement in Rotary Shears for Cutting Metal;* L. & L. J. Lamb, Berlin, Connecticut, November 10.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the inclination of the two arbors of the rotating shears to the plane of the plate to be sheared, so as to leave a free passage for that part of the sheet that is being cut off, in combination with the bevelled face of one of the shears, as herein described. We also claim the mode of setting the cutting edges of the shears to each other by having the arbor of one of them to slide in its bearings, and forced up by a set screw, in combination with the spring that draws it from the other cutter, to prevent the injurious action of the cutting edges on each other, and to admit of their relative adjustment of the two cutters, as described."

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15. For *Improvements in the Drawing Frame for the Manufacture of Yarn;* Joseph Pray and C. Stafford of East Killingly, Connecticut, November 12.

The "nature of this invention consists in making each section of

the first or back set of rollers conical, that the supply of cotton, &c., to the other rollers may be more or less, to increase or decrease the draught on the fibres, and thus regulate the size of the yarn; and also in combining with this, guides connected with the condensing tube, which is on the upper edge of a vibrating arm, the connexion between the guides and arm of the condensing tube, being made by means of levers, so arranged that when the yarn is too large, and binds, the tube shall be drawn towards the calender rollers, and thus operate the guides to carry the roping towards the smaller diameter of the conical rollers to diminish the supply."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is making each section of the first or back set of drawer-rollers of a drawing frame conical, for the purpose of regulating the size of yarn or roping, substantially as herein described.

"We also claim the vibrating condensing tube, in combination with the conical draw-rollers, for the purpose of operating the guide to guide the roving in its passage to the conical rollers, substantially as herein described."

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16. For a *Method of performing Surgical Operations without Pain*; C. T. Jackson and W. T. G. Morton, Boston, Massachusetts, November 12.

Claim.—"What we claim as our invention, is the hereinbefore described means by which we are enabled to effect the above highly important improvement in surgical operations, viz: By combining these with the application of ether, or the vapor thereof, substantially as above specified."

The merits of this invention have been so extensively discussed in the public journals, that we deem it unnecessary to say anything further on the subject.

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17. For an *Improvement in the Coffee Roaster;* James W. Carter, Boston, Massachusetts, November 12.

Claim.—"I am aware that a cylindrical roaster and furnace have been combined together and long known and used for roasting coffee, etc., and therefore I make no claim to such contrivances; but that which I do claim is the combination with the furnace and roasting-vessel, of the air space or chamber surrounding it—the same being for the purpose of preventing the too rapid escape of heat from the furnace when its (the air-chamber) induction and eduction air openings or passages are closed, as well as for other purposes, whenever desirable to so convert it, as above set forth."

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18. For an *Improvement in the Washing Machine or Rotary Fulling Mill;* Ira Avery, Tunkhannock, Pennsylvania, November 12.

A conical fluted roller is placed on a crank arm of a central shaft so as to pass around near the inner periphery of a circular tub.

Claim.—"Having thus fully described the construction and operation of my improved washing machine, or rotary fulling-mill, what I claim therein as new, and desire to secure by letters patent, is the combination of the conical fluted-roller with the tub, substantially in the manner and for the purpose herein set forth."

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19. For an *Improvement in the Machine for Handling Hides in the Process of Tanning;* A. H. Beschormann, New York, November 14.

Claim.—"The figure 4 shows a mode of fitting the rollers with plain small gear on the ends near the power, and having a small leading or intermediate pinion between each pair of wheels. The figure 5 shows the rollers carrying stud-wheels fitted with a band chain; and figure 6 shows the rollers fitted with cranks, the pins of which are jointed to one driving-bar. In either of these modifications of the means for enabling the power to turn the rollers all in one direction, the connexion with the power may be in any usual mode—therefore need not be detailed here; and as all the several parts used are well known, no claim can lie for them irrespective of the manner in which they are constructed, and the purposes for which they are employed; therefore my claim for that which is new and of my own invention, and what I desire to secure by letters patent, is limited to the application of rollers, in combination with an apron or endless web, and constructed to operate within competent vats or enclosures, when such application, combination, and construction are employed for the separate or several and successive purposes of washing, lining, vatting, tanning, stuffing, or dubbing hides, substantially as described and shown."

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20. For an *Improvement in the Cider Mill for Grinding and Pressing Apples;* G. W. D. Culp, Allensville, Indiana, November 14.

Claim.—"Having thus fully described my improvements, what I claim as my invention, and desire to secure by letters patent, is, constructing a cider press as herein described, having a tub with a grated curb within it, and a screw through its centre, as set forth, so as to dispense with a frame, and allow it to be combined with a mill for grinding the apples so that the pomice need not be handled."

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21. For an *Improvement in the Rotary Steam Engine and Pump;* Elisha Hale, Newark, New Jersey, November 14.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is putting the valves into and out of action by the united effect of the attached drivers, the elliptical raised circle, and the grooved block, substantially as described."

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22. For an *Improvement in the Tuyere;* Melvin McKay, Lyons, New York, November 14.

Claim.—"What I claim as my invention, and desire to secure by

letters patent, is combining the nozzle boxes with the curved air tube, in such a manner that their position can be so adjusted as to bring their discharge apertures nearer to, or remove them farther from, each other; thus adapting them to fires of different magnitudes, and of a greater or less degree of intensity, substantially as herein set forth."

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23. For an *Improvement in the Forge Tuyere;* Daniel C. McMillen, Persia, New York, November 14.

Claim.—"By this arrangement the blast from the tuyere is susceptible of many variations, without changing the direction of the wind, and is the most easily adapted to any kind of business. What I claim as my invention, and desire to secure by letters patent, is the construction of an adjustable bellows tuyere by the combination of a cylinder or shell, with a piston or roller placed therein to regulate and vary the blast, in the manner aforesaid."

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24. For an *Improvement in Circular Shears for Cutting Sheet Metal;* Samuel Hall, New York, November 18.

We are under the necessity of omitting the claim, because of its dependence on the drawings—it is however limited to the combination of parts by means of which the centre, on which the plate rotates as it is being cut, slides to and from the shears to describe an ellipse.

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25. For an *Improvement in the Machine for Cutting Flocks in the Manufacture of Woollen Cloth;* Asa Barber, Stephentown, New York, November 18.

Claim.—"I do not claim as new the cutting of the flocks in a dry state; but what I do claim as my invention, and desire to secure by letters patent, is the combination of the spiral revolving cutters and the bed of straight cutters with the revolving screw and the floats, operating substantially in the manner and for the purpose set forth."

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26. For an *Improvement in the Machine for Cutting Fodder;* Luke S. Rand, Townsend, Vermont, November 18.

Claim.—"I am aware that I cannot claim a simple knife elevated and depressed as described; but that which I do claim is the improvements applied to the lever and frame of the cutting knife in order to regulate the balance or weight of lever applied to the knife, as well as the angle of the cutting edge of the knife with respect to the plate against which it acts, as above explained; also, the vibratory weighted board, in combination with the cutting knife and feeding trough, the same being for the purpose as above specified."

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27. For *Improvements in the Machine for Cutting Grass;* Isaac Lard, Ashley, Missouri, November 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—

"1st. The arrangement of the revolving rake for taking the grass from the scythes as fast as cut, and depositing it in the rear, in combination with the revolving scythes, arranged and operating in the manner and for the purpose above set forth.

"2d. I claim the arrangement of the curved bar for bearing off the heads of the grass to enable the cutters to cut the grass more effectually, in combination with the frame, as set forth."

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28. For an *Improvement in the Harness Saddle;* John T. Denniston, Lynde, New York, November 20.

Claim.—"Having thus fully described the manner in which I construct my improved harness saddle, and presented also some of the advantages of that mode of constructing, what I claim therein as new, and desire to secure by letters patent, is the forming of such saddles by means of two castings, which embrace the skirt or skirts and jockeys between them, and are so formed and combined as to brace and strengthen the lower casting, their union being formed by the aid of screws, without the necessity of nailing or stitching of the leather, and the respective parts being formed and combined substantially in the manner set forth."

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29. For *Improvements in the Machine for Reaping and Harvesting Grain;* Andrew J. Cook, Delphi, Indiana, November 20.

The patentee says,—"The nature of my invention consists in the construction and movement of a rake for taking the grain or straw off the platform of the cutters at regular intervals, and in the manner of steering the machine."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the revolving rake, constructed and combined with the cutting apparatus in the manner described.

"I also claim the arrangement of steering the machine as herein fully described, in combination with the grain-cutting apparatus, as herein fully set forth."

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30. For an *Improvement in Door Fasteners;* L. R. Livingston, J. J. Roggen, and C. Adams, Pittsburg, Pennsylvania, November 24.

Claim.—"We do not claim a lever eccentric revolving on a pin for fastening the latch, but what we claim as our invention, and desire to secure by letters patent, is combining the lever eccentric with the upper screw of the keeper and the latch, as herein described."

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31. For an *Improvement in the Flues of Cooking Stoves;* D. S. Payson, Nicholas Burch, and R. M. Davis, Eaton, New York, November 24.

Claim.—"Having thus fully described our invention, what we claim as new, and desire to secure by letters patent, is the construction and arrangement of the flues as herein described, in combination with two

ovens, so that a large portion of both ovens shall be surrounded by the flue, in the manner and for the purpose set forth."

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32. For *Improvements in Machinery for Cutting Wood Screws;* Thomas J. Sloan, New York, November 24.

The object of this invention is to cut the threads on pointed wood screws, so as to form the thread on the conical point with all the turns at equal distances apart, and of a gradually reduced depth, the cone of the thread being gradually merged in the cone of the core. This is effected by causing the cutting edges of the chasers that cut the upper and the under surface of the thread gradually to approach the pitch line of the thread, as they approach the apex of the conical point.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is retarding and accelerating the motion of the alternate cutters in making pointed screws, substantially in the manner and for the purpose set forth.

"I also claim the employment of a series of cutters acting alternately on the blank to cut and finish the thread of the screw, as set forth, all placed upon the same side of the axis of the screw blank."

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33. For an *Improvement in Harpoons;* John Holmes and Abner West, Tisbury, Massachusetts, November 24.

Claim.—"What we claim as our joint invention, and desire to secure by letters patent, is the construction of the fluke or barb of the harpoon in two parts, in such manner that when it is made to enter a whale or other object of attack, one part, being movable, may turn, and thereby diminish the chance of its withdrawing; and the making of the handles or shank of several wires or rods, instead of one solid piece."

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34. For an *Improvement in the Machine for Cutting Sheet Metal;* W. Bulkley and P. Norton, Berlin, Connecticut, November 28.

Claim.—"Having thus fully described the nature of our improvements in the machine for cutting sheet metal into circular plates, what we claim as new therein, and desire to secure by letters patent, is making the main bow of the form described, in combination with the half bow which carries the shafts or spindles of the circular shears, thereby causing the shafts or spindles of the circular shears to be nearly in plane with the axis of revolution, and allowing said circular shears to be moved in or out to any required distance, without interfering with their adjustment to each other; the said half bow, when affixed in place, constituting a part of the main bow or frame, and the space between the cutter shafts, allowing of the free passage between them of the plate that is being cut, thereby admitting of the cutting of any number of articles from the same plate without its being first necessary to divide said plate into separate parts."

35. For an *Improvement in the Truss for the Cure of Hernia;* Adolph F. Ahrens, Philadelphia, Pennsylvania, November 28.

Claim.—"Having thus fully described my improved truss, what I claim as my invention, and desire to secure by letters patent, is the combination of the pad with the body spring of a truss in the manner set forth, so that the pad can be conveniently adjusted into its position, and retain its universal freedom of action, as described, by means of the double nut and screw."

List of American Patents which issued in the month of December, 1846, with Exemplifications, by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Machine for cutting Screws;* Peter H. Watson, Rockford, Illinois, December 3.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the right and left screw and sliding frame with the dies, for the purpose of centring, feeding, marking, and smoothing the bolt, while the screw is being cut upon it by the chaser, the whole being arranged and operated in the manner herein set forth."

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2. For an *Improvement in the Machine for making Barrels, Casks, &c.;* Philip Estes, Adrian, Michigan, December 3.

Claim.—"Having thus described the construction and operation of my improved machine for making barrels, casks, &c., what I claim therein as new, and desire to secure by letters patent, is the attaching the howeling, crozing, and chamfering cutters to the disk, in such a manner as to give them an adjustable and an elastic outward bearing against the inner side of the ends of the hooped staves of a barrel or cask, by means of stocks, sliding plates, radial slots, spring, set screws, collar, connecting rods, and lever, combined and operating substantially as herein set forth."

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3. For an *Improvement in the Hill Side Plough;* James Rorabough, Luney's Creek, Hardy county, Virginia, December 3.

The mould board, we are informed, is a section of a cone, which may be shifted from side to side, to plough the side of a hill back and forth. With this mould board a hook is used which keeps it in place, and prevents it from moving too far when shifted.

Claim.—"I claim the shape and use of the hook, in combination with the conical mould board, for the purpose to keep the mould board in its position, and at the same time to serve as a guide in the motion of the mould board, when thrown from one side to the other of the plough, as described before."

4. For *Improvements in the Cooking Stove;* Samuel and G. J. Conrad, Berlin, Pennsylvania, December 3.

We have to omit the claim, because of its reference to, and dependence on, the drawings. The first section is limited to the combined mode of locking the back plate, and the second section to the arrangement of the dampers, in combination with two flues.

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5. For an *Improvement in the Harpoon;* Charles Randall, Palmyra, Georgia, December 3.

Claim.—"What I claim as my invention, and for which I desire to secure letters patent, is the attachment of the movable fluke, behind the stationary flukes, resting against its points on the outer end, and resting against the shoulder in the shank, thus supporting the inner end without depending on the rivet, which is liable to be weakened by rust."

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6. For *Improvements in Weaving Looms;* Melchoir Bretzger, Pittsburg, Pennsylvania, December 5.

We are under the necessity of omitting the claims in this case, on account of their reference to, and dependence on, the drawings.

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7. For an *Explosive Compound, known as the Gun Cotton;* Christian F. Schœnbein, of Basle, Switzerland, assigned to W. H. Robertson, United States Consul at Bremen, December 5th, 1846, to run fourteen years from the 8th of October, 1846, the date of the letters patent granted in England.

Claim.—"What I claim as my discovery, and ask a patent for, is treating vegetable fibrous substances and other organic matter, being of a chemical composition analogous to that of the said vegetable fibrous substances, with a mixture of nitric acid of 1·5 specific gravity, or thereabouts, and sulphuric acid of 1·85 specific gravity, or thereabouts, at the common temperature, or a lower one, by which compounds are formed, which, on being heated more or less, ignite suddenly and produce gaseous matters.

"Of all the vegetable substances known to me, cotton-wool is the most fit material for producing an explosive compound, answering the purpose of gunpowder; and I therefore claim the use of cotton-wool for this purpose, when prepared as herein directed."

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8. For an *Improvement in the Machine for Polishing Cutlery;* Wm. Vine, New York, December 5.

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is the combination of the spiral feeder, arranged and operating substantially as herein set forth, with polishing wheels."

9. For *Improvements in the Machine for Planing, Mortising, and Tenoning Wood and Metals;* Thomas A. Chandler, Rockford, Illinois, December 5.

The patentee says,—"The nature of this invention and improvement consists in combining with the mortising machine, having two ordinary parallel cutters, or leaders, moved alternately by racks and pinion, or segments, two alternate vibrating planes, or cutters, that are caused to cut from the centre of the mortise, towards each end thereof, alternately, in the manner of planes with side cutters—the cutting being performed in parallel right lines, and immediately succeeding the operation of the parallel cutters, or leaders, whilst the levers to which said cutters are attached, have a compound motion from and around their fulcra, caused by the end of the pendulum, which is made with eccentrics, that act against shoulders on the levers of said combined planes and side cutters, and connecting said levers to the pendulum by oblong mortises and adjustable screw pins, inserted into the pendulum."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining with the two parallel alternate moving headers, two alternate vibrating cutters connected to and moved by the cogged and eccentric pendulum that moves the headers; whether the said several parts be constructed, arranged, and operated in the manner, and for the purpose above described, or other mode, substantially the same."

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10. For *Improvements in Machinery for making Barrels;* Horace Baker, McLean, New York, December 9.

Claim.—"Having thus fully described my improvements, what I claim therein as new, and desire to secure by letters patent, is the combination of the carriage for holding the stave, with the two planes in one stock or frame, at a distance equal to half the length of the stave, and both cutting outward from the centre of motion, as herein set forth, substantially in the manner and for the purpose described."

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11. For an *Improvement in the mode of Fastening the Round Tenons of Bedsteads;* Benjamin Hinkley, Utica, New York, December 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the sharp metal spurs or segments of threads formed with a sharp and reduced edge on the tenons, in combination with the mortises in the posts, with recesses for the admission of spurs, that the shoulders of the rails may be brought up to the posts before the spurs are worked into the wood, whereby perfect joints can be obtained at each end of a rail, and the sacking pins be placed and retained, all substantially as described."

12. For *Improvements in the Apparatus for Heating, Evaporating, and Refining Liquids, specially intended for the manufacture of Sugar;* Norbert Rillieux, New Orleans, Louisiana, December 10.

Claim.—"Having thus pointed out the principle or character of my improvements, and the manner of constructing and applying the same, what I claim as my invention and desire to secure by letters patent, is: *First*—The method of heating the saccharine juice, in a heater, preparatory to its introduction in the evaporating pans, by means of the waste hot water, or escape steam from the evaporating pans, substantially as described. *Second*—The method of clarifying saccharine juice by heating it in a heater provided with a spout for the discharge of the impurities in the form of scum, and a pipe for drawing off the clear liquid, the said pipe being so arranged as to receive the liquid from the heater below the level of the spout which discharges the scum, and then bending up above the said spout to cause the liquid in the heater to rise sufficiently high to discharge the scum, substantially as described. *Third*—The method of cooling and partially evaporating saccharine juice or other liquids, by discharging the same in the form of spray or drops in a chamber, where it meets with a current of air substantially as described; and this I also claim, in combination with a condenser, substantially as herein described, whereby the liquid intended to be concentrated is prepared for the evaporating pans, and used as a means of condensing the vapor from the pans in which it is to be concentrated, or by means of which the water used for the condensing jet is recooled, substantially as described.

"And, *fifth*—the method, substantially as described, of combining a vacuum striking pan with a series of evaporating pans, the last of which is independent of the striking pans, and the last of the series of evaporating pans can be in connexion with the condenser, and work independently of each other, that either the striking pan or the series of evaporating pans can be worked without the other, as described."

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13. For an *Improvement in Bedsteads;* Henry Pace, Senior, Cincinnati, Ohio, December 10.

Claim.—"Having thus described my improvements, what I claim as my invention, and desire to secure by letters patent, is the employment of a centre rail or its equivalent, to which are hinged arms that support the side rails, instead of their being fixed to the posts; the whole being arranged and combined substantially in the manner and for the purpose described."

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14. For an *Improvement in Weavers' Harness;* Kasimer Vogel, Lowell, Massachusetts, December 10.

Claim.—"Having thus fully described the manner in which I form my improved heddles, to be used in my new manufacture of weavers' hames, what I claim therein as new, and desire to secure by letters

patent, is the making of said heddles by the doubling and twisting of yarn by two sets of spools, each of which will form a cord of three or more strands, and the combining of such strands of yarn, so as to form the ends of the eye, by causing the spindles and spools constituting each set to cross and recross, so as to change places for the purpose of interlocking the yarn, and obviating the necessity of tying a knot or of forming a loop of the ordinary kind. And this I claim, whether the crossing and recrossing of the spindles be effected by hand or by special machinery adapted to that purpose."

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15. For an *Improvement in Cast Iron Wheels for Locomotives and Cars;* Alexander Small, York, Pennsylvania, December 10.

Claim.—"Having thus fully described the nature of my improvement in the wheels for locomotive engines, cars, and other carriages used on railroads, what I claim therein as new, and desire to secure by letters patent, is the placing of the spokes of such wheels at such an angle with the plane of the wheel as that they shall overlap each other, in the manner herein described and represented, whereby a sustaining power is applied to the rim of the wheel, by which its cross fracture is rendered so difficult as to insure its safety under all ordinary usage."

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16. For an *Improvement in Knobs for Doors, &c.;* L. R. Livingston, J. J. Roggen, C. Adams, W. Phillips, and R. Phillips, Pittsburg, Pennsylvania, December 10.

Claim.—"We do not claim to be the inventors of a glass-headed knob, nor of the method of inserting a metallic screw, nut, or pin, into fused glass, the same having been made and done, to our knowledge, before our application. What we do claim, and for which we now ask letters patent, is the mode of combining a metallic neck and collar with a glass head, by means of wire-loops or metallic projections united with the collar, and extending into a glass head, while the glass is in a fused state, as herein described."

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17. For an *Improved mode of casting Door Knobs;* William Higgs, Utica, New York, December 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode herein described of producing the entire hollow knob in casting, through the use of the dovetailed neck, the sand-core and tube connected, as above described and shown in figure 1, and the placing of these in conjunction for the reception of the metal in casting the knob, the whole being moulded, arranged, and performed substantially in the manner above set forth and described.

"I also claim the combination of the metal tube, with the sand-core, and the dovetailing of the neck, in the manner and for the purpose set forth."

18. For a *Machine for making Cigars;* Hosea Peirce, Winchester, New Hampshire, December 10.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the lower slide with its hinged matrix, in combination with the upper slide, stop, and gate, arranged and operating substantially in the manner and for the purpose herein set forth."

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19. For an *Improvement in the self-acting Brake for Railroad Cars;* William McCammon, Albany, New York, December 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructing of self-acting and self-retaining anti-collision brakes for railroad cars, by means of the combination of the bumper, spring, brake-shaft, ratchet, and pall, with each other, and with the rubbers, substantially in the manner and for the purpose herein set forth."

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20. For an *Improvement in the Churn;* Samuel B. Howd, Arcadia, New York, December 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a churn having a rotary dasher, which, when in motion, draws the milk and cream in at its end and expels it at its periphery, against stationary breakers fixed at the inner circumference of the tub in which it revolves, in the form and manner, and for the purpose in the foregoing specification set forth."

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21. For *Improvements in the Machine for setting the Tires of Wheels;* George H. Thatcher, Ballston, New York, December 12.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the before described mode or manner of setting a tire around felloes of wheels, by the application of a jointed band, in the manner which I have described, for the purpose of tightening the felloes and spokes, and setting the tire by means of the compression caused by drawing the ends of such flexible bands towards each other by the lever and catch, or by the nut and screw, above described, or other means substantially the same, such as by a wedge or key, and overlapping the ends and securing the tire by bolts, held by nuts or riveted, or by other means substantially the same."

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22. For an *Improvement in the Crank Axle for Carriages;* Oren Tracy, Fitchburg, Massachusetts, December 12.

Claim.—"I therefore claim the additional pipe-box, in combination with the crank of the axle, and either with or without the brace; the whole being arranged, constructed, and operated substantially in the manner and for the purpose as herein above specified."

23. For an *Improvement in Cooking Stoves;* Samuel Winrott, Adams county, Pennsylvania, December 15.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arranging and combining the fire-chamber, placed below the oven, with the flues and damper, in such a manner that the flame and gaseous products of combustion can be carried from the fire-chamber around four sides of the oven, substantially as herein set forth."

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24. For an *Improvement in the Washing Machine;* E. D. Wilson, Philippi, Virginia, December 15.

Claim.—"What I claim as my own invention, and desire to secure by letters patent, is constructing the washing machine with a *swinging concave of rollers*, upon which the clothes to be washed are placed, in combination with a swinging box, open at top and bottom, for holding the clothes in contact with the rollers, and moving them back and forth over the same, having a corresponding follower placed therein, moved simultaneously with said concave of rollers, by means of a triple crank and connecting rods; the concave of rollers moving in one direction, whilst the box, with the follower and clothes therein, moves in an opposite direction, by which the double action is produced, as set forth."

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25. For an *Improvement in the Spinning Machine;* Hiram F. Wheeler, Springville, Pennsylvania, December 15.

The patentee says,—"The nature of my invention consists in securing the usual form of spinning wheel head to a vibrating carriage, running on ways, and combined with a treadle and driving band wheel, in such a manner that a person can spin wool or cotton rolls, without moving from his or her position, and walking to and fro, as is required to be done with the ordinary spinning wheel."

Claim.—"Having thus fully described the construction and operation of my improved spinning machine, what I claim therein as new, and desire to secure by letters patent, is the combination of the ways with the spring, for the purpose of preventing the wheel head carriage from coming back with too much force, and also for preventing its recoil, and retaining it while the roll is spliced, substantially as herein set forth."

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26. For an *Improvement in the Machine for Washing Clothes;* Edward D. Tippet, Georgetown, District of Columbia, December 17.

Claim.—"Having thus described the combination and arrangement of the several parts composing my washing machine, what I claim therein as new, and desire to secure by letters patent, is the manner of combining the washer and tub, as herein described, by means of which various thicknesses of clothes may readily pass through be-

tween the extreme inner periphery of the tub and the washer, when driven by the centrifugal force created by the motion of the tub, to its extreme inside."

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27. For an *Improvement in Wheels for Railroad Trucks;* Fowler M. Ray, New York City, December 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making railroad wheels in two parts, fitted together substantially as herein described, when embraced and held together by flanches and screw bolts passing through the flanches, in manner and for the purpose substantially as herein described. And I also claim, in combination with this method of constructing and connecting the two parts of railroad wheels, interposing the cushion of leather, or other elastic substance, between the inner and outer portions of the wheel, substantially as described, whereby railroad cars, &c., are relieved of a portion of the jar consequent on the striking of the wheels against the rails, as set forth."

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28. For an *Improvement in the Machine for Crushing and Cracking Corn and Cobs;* W. Beale, Jr., and B. S. Hale, Lowell, Massachusetts, December 17.

Claim.—"Having thus fully described our invention, what we claim therein as new, and desire to secure by letters patent, is the combination of the main cylinder with the small cylinder, (revolving in an opposite direction at a slower speed,) the adjustable concave, and the cleaving concave, respectively armed with teeth, and operating substantially in the manner and for the purpose herein set forth."

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29. For an *Improvement in Cotton Mattrasses;* W. H. Robertson, Consul of the United States for the Port of Bremen, December 17.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, *first*, making mattrasses by confining within a ticking or tickings (made of any material) layers of glazed cotton batting, or unglazed batting, with glazed paper or cloth interposed, substantially as described, to prevent the fibres of the different battings, and those of each batting, from matting together, as described. And, *second*, confining the compressed cotton between two cloths, connected together by means of a cord or cords, when this is combined with a ticking or outer covering, substantially as above described."

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30. For an *Improvement in the Self-adjusting Skirts for Ladies' Dresses;* Sewell Folsom, Bridgeport, Connecticut, December 17.

Claim.—"Having thus fully described my invention, I do not claim the introduction of any substance by weaving; nor do I claim the catching up of cords by sewing them into the cloth of the skirt; but what I do claim, and desire to secure by letters patent, is the method of applying the spring materials to the cloth of the skirt, by giving

them the spiral, diamond, or circular, or angular, or other curve and irregular forms, so as to break up the plain horizontal lines, by connecting them with other lines or not, as herein more fully described, for the purpose of forming self-adjusting skirts."

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31. For an *Improvement in the Snow Plough, for Clearing Rail-roads;* Daniel D. Stillwell, Philadelphia, Pennsylvania, December 22.

Claim.—"Having thus fully described the manner in which I construct and combine the respective parts of my snow-plough, what I claim therein, and desire to secure by letters patent, is the combining the share and inclined plane with the double mould-boards, so that the latter may be made to turn on a bolt or pivot, in such manner as to allow the double mould-board to have its position changed on said inclined plane so as to adapt it to the properly dividing of the heap or drift of snow, substantially as herein set forth."

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32. For an *Improvement in the Cooking Stove;* Joseph S. Silver, New York City, December 22.

Claim.—"Having thus fully described the manner in which I construct my anthrax cooking-stove, what I claim therein as new, and desire to secure by letters patent, is the special arrangement and combination of the respective parts thereof, as herein set forth: that is to say, I claim the combining of the two ovens or boiler spaces situated on the sides of the fire chamber, with the rear oven, the draught from the fire chamber descending and passing under the partition-plates, on its way to the exit-pipe; and the space under the rear oven being heated by means of the heated air from the air-chamber under the fire-grate, the whole being constructed substantially as herein set forth."

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33. For an *Improvement in the Self-acting Brake for Carriage Wheels;* Samuel Cope, Salem, Ohio, December 22.

Claim.—"Having thus fully described the nature of my improvement in the self-acting brake for spring carriages, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have combined the brake with the spring carriage, by means of the arms, of the straps, or rods, connecting the brake-shaft with the hind axle; of the strap connecting the brake-shaft with the fore cross-bar, through the intermedium of the spring and the strap, made fast to the carriage body and to the swingle tree, so as to operate in the manner set forth. I do not claim either of the above-named parts individually, but I limit my claim to their combined arrangement and operation, as herein fully made known. And this I claim, whether the respective parts be formed precisely in the manner described and represented, or in any other that is substantially the same, producing a like result by equivalent means."

34. For an *Improvement in the Cotton Gin;* Edwin Keith, Bridgewater, Massachusetts, December 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is placing the mote brush where the rotating stripping brush acts on the teeth of the saws, substantially as described, so that the mote brush shall act on the fibres to separate the motes as the rotating brush strips the fibres from the teeth of the saws, as described."

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35. For an *Improvement in the Machine for Counting;* George W. Edelman, Philadelphia, Pennsylvania, December 22.

Claim.—"What I claim as my invention, is the combination with the liberating latch, and stop, hereinbefore described, of the several mechanical devices herein described for operating the count wheel, so as to adapt the instrument to the purpose of counting in the process of addition without requiring the eyes to be turned from the figures."

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36. For a *Mode of Preventing the Deposit of Saline, Calcareous, or other Earthy Matters, in Boilers;* S. D. Anthony, and Daniel Barnum, New York City, December 22.

Claim.—"We are aware that many vegetable substances have been tried for similar purposes, with varying results, and therefore we do not herein claim any general application of vegetable matters to produce these results; but we do claim as new, and as our own discovery by practical research and experiment, and desire to secure by letters patent of the United States, the application and use of mahogany saw-dust for the purpose of preventing or lessening the formation of any injurious scale on the metal of which boiler flues are formed, substantially as above described."

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37. For an *Improvement in Coffee Pots;* John R. Remington, Lowndes county, Alabama, December 22.

Claim.—"Having thus fully described the nature of my improvement, what I claim as new therein, and desire to secure by letters patent, is the connecting a reservoir, having a double bottom, as described, with the coffee pot, in the manner described, by means of a safety valve, constructed substantially in the manner and for the purpose set forth."

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38. For an *Improvement in Stoves;* Benjamin Shepard, Boston, Massachusetts, December 23.

We omit the claim because it refers to, and is dependent on, the drawings.

39. For *Improvements in the Machine for Carving Wood, Stone, and Other Materials;* Hezekiah Augar, New Haven, Connecticut, December 23.

Claim —"I do not claim the horizontal movements of the carriages, as herein described, in themselves, (they having been before known and used,) but only in combination with the other parts and movements of the machine; nor do I claim the using of a pattern, or the operation of the cutting tool and guide, as such, nor any other part which has been heretofore used: but what I do claim as my invention, and desire to secure by letters patent, is the *circular adjustable chucks*, by means of which the cutting tool can be made to operate not only on a greater variety of surface, but also with much more accuracy and despatch as well as convenience. And I also claim the manner in which I have arranged and combined the several parts and movements of the machine, to wit: combining the two lateral motions of the carriages at right angles with the motion to incline the tablets, and the manner of shifting the chucks, in the course of the operation, so as to bring all parts of the surface (except the bottom) of the block or material to be carved equally within the operation of the cutting tool, while the cutting tool is governed by the guide working on the pattern, thereby enabling the workmen to carve five sides of a cubical figure, and consequently to carve all parts (except the bottom) of irregular figures generally by the machine, operating substantially as herein described."

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40. For an *Improvement in the Slide Valves of Steam Engines;* Stephen F. Gates, Boston, Massachusetts, December 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the following, viz: the above described means of neutralizing the effect of the pressure of the steam (or fluid, as the case may be) upon the back of the valves, and equalizing the pressure of the atmosphere on the upper side of the blank valve, and on the under side of the valve C, thus preventing friction, and allowing the valves to move with perfect ease when under a pressure, as above set forth, viz: by applying or attaching the blank valve to the commonly used slide valve C, as above described, in combination with the false aperture, and the aperture to the atmosphere through the cover, and the inverted seat, as above described, and all operating as above mentioned and set forth."

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41. For an *Improvement in Locomotives;* R. F. Stevens and L. B. Pitcher, Syracuse, New York, December 28.

The patentees say,—"Our invention consists in the application to the wheels of locomotives, of an endless chain combined with gripers, clamps, or catches, in such a manner that they will be fastened to the rail under the foremost wheels, and released under the rear ones, by the revolution of the wheels in whichever direction they may be running."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of gripers, clamps, or catches, with the endless chain, as described, in such a manner as that they will seize the rail, as they come down from over the front wheel, and release it as they rise upon the rear wheel, for the purpose and substantially as described."

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42. For an *Improvement in the Machine for Cutting Sausage Meat;* Edward D. Tippett, Georgetown, District of Columbia, December 28.

Claim.—"Having thus described the combination and arrangement of the several parts composing my meat machine, what I claim therein as new, and desire to secure by letters patent, is the combination of the grooved tub with the revolving knife, as herein described, with the combined relative motion of the tub and knives, as herein set forth, whereby the meat is kept continually in motion, and thereby presented to the knives in various and changing positions."

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43. For an *Improvement in Cooking Stoves;* James R. Stafford, Cleveland, Ohio, December 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination with a cooking stove, of an air chamber between double plates, placed or continued on the sides of the fire-chamber, opposite the oven, in the manner and for the purpose described; the object of this air space being to prevent a radiation of the heat from the outer surface of the stove on the sides, to which are affixed the double plates; and the air, when heated therein, by absorption, is then conducted under and into the oven, for the purpose of heating the same, or it may be used for the purpose of heating apartments, when not needed in the oven, or for the purpose of increasing the draught of the stove."

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44. For an *Improvement in the process of Finishing Raw Hide Whips, by pressing and planing them;* Charles Baeder, Philadelphia, December 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the process herein described of finishing raw hide whips, viz: submitting them to heavy pressure in suitable dies, and subsequently smoothing them by planing with suitable planes, all as herein described."

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45. For *Improvements in the Bellows of that kind of Musical Instruments called Seraphines, &c.;* Jeremiah Carhart, Buffalo, New York, December 28.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making an exhausting bellows for reed instruments, consisting of two chambers, combined with each other, and with the reeds placed above, so that the chamber next to the sounding board

shall be enlarged by a weight on the first flap, substantially as herein described, and exhausted by the action of the second flap, substantially as described. I also claim the method of making the valves, by means of strips of leather, or other materials having like properties, placed over a hole or series of holes, in combination with a cord of India-rubber or other elastic substance, substantially as described, whereby the leather valve is prevented from sagging, when stretched by use, and making noise by striking the valve-seat, as described."

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46. For an *Improvement in Gas Burners, called the "Phlogostatic Apparatus;"* Etienne Maccaud, Echallens, Switzerland, December 28.

Claim.—"Having now explained in what my apparatus consists, I now proceed to state in what my claims to novelty consist; and before doing so, I would state that I do not claim any thing new in the construction of burners, or any thing which may have been before in use. But what I do claim is—

"First—The creation around the burner of a hot-air reservoir, (by the means of my metallic or other web,) heated by its proximity to the focus of the combustion, which keeps the flame from all cold air and from all streams of the external air, however feeble they may be, so that the air which feeds the flame comes to it by the single aspiration of the heat, and not by the external force of the atmospheric currents.

"Secondly—I claim the placing of a similar web, as represented with regard to Fig. 1, on the top of the glass, when a current of air is found to proceed from above, and beat down upon the glass; and this second part of my invention I claim only in conjunction with the first part thereof."

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47. For an *Improvement in Clocks and Time-keepers*; Chauncey Boardman and Joseph A. Wells, Bristol, Connecticut, December 28.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the placing of the driving spring and fuzee on the same shaft, connecting the same to the movement frame of the clock, and the combination of the same with the barrel F, and movements of the clock, substantially in the manner and for the purpose herein set forth."

List of American Patents which issued in the month of June, 1842, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For *Improvements in the Thrashing Machine and Horse Power;* Jesse Bowles, Louisa, Virginia, June 11.

Claim.—"What I claim as my invention, is the dovetail form of he base of the beaters, adapted to be taken out of, and inserted into,

the dovetailed grooves in the peripheries of the rings of the cylinders, as described. I likewise claim the construction and arrangement of the curve, so that it can be adjusted to the cylinder at pleasure, by the screws and nuts, and likewise be self-adjustable when any hard substances enter the machine, by means of the obtuse angled perforations and rods passing into said perforations, as described."

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2. For an *Improvement in Steam Valves;* Stephen Parks, Jr., Brooklyn, New York, June 11.

Claim.—"I do not claim the invention of a slide valve, or of an expansion valve, separately; but I do claim as of my invention, the slide valve, with such additional steam ways and faces thereto, in combination with such vibrating expansion valves attached thereto, and connected to each other by a bridle or rod, and closed at will by nuts or slides, the nuts or slides being adjusted and fixed by right and left handed screws, in the manner set forth, or in any other manner that has substantially the same effect."

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3. For an *Improvement in the Machine for Planting Seed;* Wells Kilburn, Lawrenceville, Pennsylvania, June 11.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the double slide for dropping seed in a single furrow, constructed and arranged as herein described, and in combination therewith, the vibrating lever for drawing the slide back, as above represented. Second, I claim the hollow tooth, having a double shank, constructed in the manner and for the purpose before stated. Third, I claim the tube running down into the hollow tooth, so as to allow it to be raised and lowered, combined and arranged as herein set forth. Fourth, I claim the arm or crane for making the furrows, constructed and arranged in the manner and for the purpose before described."

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4. For an *Improvement in Valves for Stoves;* Henry Stanley, West Poultney, Vermont, June 11.

Claim.—"Having thus fully described the nature of my invention, and shown the manner in which the same operates, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have arranged the three valves or dampers, as herein described and represented, and combined the same with the heated air chamber below an elevated oven, so that by the movement of one of them, the three shall operate simultaneously, as herein set forth; and this I claim whether said valves are connected together, and combined with the elevated oven precisely in the manner described, or in any other which is substantially the same, producing a like effect upon the same principle."

5. For an *Improvement in Water Wheels;* Esau and Jacob Whitney, and William F. Card, Burns, New York, June 11.

Claim.—"What we claim as our invention and improvement, and desire to secure by letters patent, is the construction and arrangement of the buckets on the wheel by making them nearly of a sickle or falciform as herein set forth, in combination with a scroll or shute in which it turns in closing said wheel and the various forms of discharging apertures or ventways on the periphery of the wheel, the whole being constructed and operating as herein described; using for the construction of such wheels, iron, or any other material proper for such wheels."

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6. For an *Improvement in the Cap Plates of Rotary Cooking Stoves;* Maynard French, Assigned to Ira French, Cincinnati, Ohio, June 11.

Claim.—"Having thus fully described the nature of my improvement in the rotary stove, what I claim therein as new, and desire to secure by letters patent, is the casting of a wide rim or hoop, upon the stationary top plate of the stove, with a pin or pivot, rising from the centre of said plate to enter a socket in the top plate; and the casting upon the rotary top plate a narrow rim to embrace the upper edge of said wide rim, as described; these parts being claimed only in combination with each other as set forth, and not individually or separately."

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7. For an *Improvement in Saddles with Spring Side Bars;* Abraham Freed, Marietta, Pennsylvania, June 11.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described arrangement of the spring guards in combination with the spring bars, producing double metallic spring sides to the saddle, as herein set forth—that is to say, having guards shaped and arranged as above described, and set forth, and fastened at the larger ends to the under side of the cantel—whilst the smaller ends are inserted loosely into the sheaths or pockets fastened to the cantel, and preventing the pad from touching the spring side bars as the seat of the saddle is depressed, whether combined and arranged in the manner set forth, or in any other substantially the same."

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8. For *Improvements in Marine Steam Engines;* Joseph Maudslay and Joshua Field, Lambeth, England, June 11—antedated May 7, 1839—date of English Patent.

Claim.—"In conclusion, we desire to be understood that the particular features of novelty claimed by us under this patent, are, first, the adaptation of two steam cylinders to one engine in the way above described, in order that the steam may act simultaneously in both cylinders, and the pistons be made to rise and fall together, so that the combined action of both pistons may be applied to one crank on the paddle shaft. Second, the construction and adaptation of a piston

with two rods working in one steam cylinder of large area, both piston rods being connected to one cross head above, in combination with the described arrangement which gives motion to the crank below, by a single connecting rod. Third, the method above described of adjusting the expansion valves of combined engines; and Fourth, the mode of constructing the beams of the framing of steam engines as hollow tubes, by the combination of plates connected by bolts or rivets."

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9. For *Improvements in Rotary Steam Engines;* J. T. and B. Beale, East Greenwich, England, June 11—antedated July 17, 1841—date of English patent.

Claim.—"We claim, firstly, the adaptation of cylindrical rolling steam stops or pistons, in whatever way they may be used in rotary engines or rotary pumps, provided their construction and operation be substantially the same with that above set forth. Secondly, the introduction of non conducting or imperfectly conducting substances, between or around the eduction passages, for the purpose of preventing the eduction steam abstracting heat from the induction steam, and thereby economizing fuel."

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10. For an *Improvement in the Steam Engine;* William Kelley, Pittsburg, Pennsylvania, June 18.

Claim.—"Having thus fully pointed out the nature of my improvement in the rotative reciprocating steam engine, and described the manner in which the same operates, what I claim therein as new, and desire to secure by letters patent, is the manner of combining the steam cylinder with the balanced lever, so that the two may rotate together, as herein set forth: that is to say, the cylinder and the lever being each sustained by a single revolving axis, or shaft, standing parallel to each other, and at such distance apart, as is equal to one half the length of the stroke of the piston; the piston rod being connected to the balance lever by means of a vibrating joint, constructed in the manner herein described, or in any other that is substantially the same in its operation, and thereby obviating the danger of cramping or binding as the piston reciprocates back and forth in the cylinder."

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11. For an *Improvement in the Lard Lamp;* Ellis S. Archer, Philadelphia, Pennsylvania, June 18.

Claim.—"I do not claim to be the original inventor of a tube placed in the centre of the lamp, as this has heretofore been done, but what I do claim as my invention, and which I desire to secure by letters patent, is the combination of the hollow button, connected with the tube to be filled with lard, and these with the common Argand lamp, in the manner and for the purpose set forth."

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12. For *Improvements in the Paddle Wheel for Propelling Vessels;* Alexander Connison, Newark, New Jersey, June 18.

Claim.—"Having thus fully described the nature of my invention

and shown the manner in which the same is carried into operation, what I claim therein as new, and desire to secure by letters patent, is the manner herein set forth of forming the paddle wheels of vessels to be propelled by steam, and of combining said wheels with such vessels, so as to cause them to be operated upon by the pressure of the superincumbent water, upon the principle herein fully made known: that is to say, I claim the construction and use of propelling wheels which are to be contained within a case, or shield, of the kind herein described, and which are furnished with paddles, the faces of which form an angle with the radii of the wheel, and which are so combined with the shield, or case, which partially surrounds the wheel as to exhaust the water from a part thereof, corresponding with that marked in the accompanying drawing, and by which the pressure of the superincumbent water is made to act upon the paddles as they emerge from said case, or shield, and thereby to force the vessel forward with a power proportioned to said pressure; the whole construction and manner of operation being substantially the same with those herein fully made known."

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13. For an *Improvement in the Mode of Regulating the Drag of Yarn in the Cap Spinner;* Jesse Whitehead, Manchester, Virginia, June 18.

Claim.—"Having thus fully described the nature of my improvements in the spinning apparatus, what I claim therein as new, and desire to secure by letters patent, is the so forming of the caps, when used for the spinning of filling upon spools, as that the yarn in its passage from the eye to the bottom of the cap, shall be in contact with the lower portion of the cap only, said form being given thereto for the purpose, and substantially in the manner above set forth.

"I also claim the graduating the drag of the yarn by the pressure of a ring attached to an elastic, or spring rod, the force of which is graduated to the varying diameter of the cap, as herein described. And I do hereby declare that my invention does not, in this part of it, consist in, or depend upon, the precise means by which the pressure of the ring is graduated, as this may be variously modified, but I have pointed out the arrangement of the respective parts for effecting this object which I deem the most convenient; my improvement in this part, however, consists in the use of this graduated pressure made by means of a ring, by any arrangement of the apparatus which is substantially the same as that described, and which produces a like effect by equivalent means."

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14. For a *Machine for Cutting Laths, Staves, &c.;* Ebenezer Day, Grand Detour, Illinois, June 18.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the arrangement of the spring pannel in combination with the upper bar for gauging and sustaining the bolt, and for throwing the pannel towards the cutter after the knife has passed

through the bolt to prevent the board falling down between the table and cutter, or knife, as before described."

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15. For an *Improvement in the Wind Mill;* John R. Remington, Aberfoil, Alabama, June 18.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the combination of the revolving concentrating guides with the centre revolving wheels, as before described."

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16. For an *Improvement in the Self-adjusting Carriage Lock;* William Clayton, Marshalton, Pennsylvania. Assigned to Samuel Guss, Westchester, Pennsylvania, June 18.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is causing the rubbers on the ends of the vibrating sliding bar to traverse, and press against segments of the circumference of wheels, always at the same distance from the centres thereof as the carriage body rises and falls vertically, by means of the aforesaid combination of branched arms and circular clasps, sliding boxes, and connecting bar, and to the vibrating axle, said axle moving horizontally in the segment of a circle described from the centre of the permanent box of the same; whether the parts for producing the above effect be arranged precisely in the manner above stated, or in any other mode substantially the same."

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17. For *Improvements in the Saw Mill;* Lemuel Hedge and Edwin F. Johnson, New York City, June 18.

Claim.—"We claim and desire to secure by letters patent, the following improvements:

"First—The apparatus, self-acting, or operated by hand, by which the saws, after having completed a cut one way through the timber, are moved in the direction of their axes the requisite distance, suited to the thickness of the stuff sawed before commencing the cut in the opposite direction; that is to say, we claim the graduated racks on the saw frames, and sliding bolt, in combination with the saws, as herein described.

"Second—The mode by which the pressure of the driving belt upon the saw pulleys, is made to bear upon a thimble or tube enclosing the saw arbors, and not upon the arbors themselves, as herein described.

"Third—The mode of communicating the motion from the saw pulleys, so as to produce a progressive motion in the saws and the frame which supports them, or in the platform on which the timber to be sawed rests, in combination with the mode of changing or reversing that motion in the intervals of completing and commencing the cut each way, by an apparatus self-acting, or worked by hand, as herein described."

18. For an *Improvement in the Steam Boiler;* L. E. Hopkins, New York City, June 18.

Claim.—"I claim the particular manner of constructing the flues and water spaces in radiating sections, or compartments, and of combining the same with the other parts, as described and represented; by which construction and arrangement the said spaces are in the same number of divisions, rendered more convenient to enter, repair, or clean, whilst a larger surface is exposed to the action of the fire than when the flue spaces consist of round tubes, as heretofore."

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19. For an *Improvement in the Machine for Cutting and Slitting Tortoise Shell;* William Redheffer, Penn Township, Pennsylvania, June 18.

Claim.—"What I claim, is the mechanical combination and arrangement of the saw, with the mode of holding the pieces on the carriage, for slitting tortoise shell, as herein described."

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20. For *Improvements in the Machine for Spinning, Twisting, and Curling Hair;* Hiram Burnham, New York City, June 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of giving the first twist, or kink, to the hair, by passing round the spiral worm, in going through the first conical pulley, as described.

"I also claim the spiral, around which the hair passes, in combination with the conical pulley, and also with the main pulley and flyer, for the purpose and in the manner described."

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21. For *Improvements in the method of Tapping or Boring Pipes under Hydrostatic Pressure;* H. Ariel Norris, New York City, June 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the boring, tapping, and making conducting attachments to water or other pipes, while under hydrostatic pressure, by means of a *close chamber,* within which the drill, tap, and ferulet are operated, according to the principles herein set forth, and by which the workman is protected during the work, from the flow of water, or other fluid, from the pipes.

"I also claim the combination of essential parts, such as the chamber, the lid, and the valve, by which that form of machine herein described is made efficient."

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22. For an *Improvement in Seraphines and other Reed Musical Instruments;* James A. Bazin, Canton, Massachusetts, June 22.

Claim.—"Having thus described my improvement, I shall claim the manner of arranging the wind chest, or connecting it with the reservoir bellows, as herein before described: that is, by making the

intervening top part of some flexible material, by the vibration of which the tone is greatly increased; and hinging the wind chest to the bar, as set forth, so as to allow of said wind chest's being raised, in order to move the key-board, or of being turned back, for the purpose of turning or repairing the reeds, without disconnecting it from the reservoir bellows.

"Also, the manner of changing the pitch of the instrument, by the movable key-board, by means of which music can be transposed from one key into any other, without altering the fingering.

"Also, the manner of softening the tone of the instrument, by diminishing the dip of the keys, and by that means the quantity of wind which passes through the reed plates, the whole being substantially as above set forth."

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23. For an *Improvement in the Hydrant Cock;* Levi Magers, F. D. Davis, and W. Dukehart, Baltimore, Maryland, June 22.

We omit the claim because of its dependence on the drawings.

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24. For an *Improvement in the Smut Machine, for cleaning Wheat;* John Wilson, Gentsville, South Carolina, June 22.

Claim. –"What I claim as my invention, and desire to secure by letters patent, is the grain wheel, constructed substantially as herein before stated, in combination with the fan, in the manner and for the purpose set forth. I also claim the box having partitions, in combination with the fan and grain wheel, as herein specified."

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25. For an *Improvement in the Spark Arrester for Locomotive Chimneys;* Jona. Hodges, Taunton, Massachusetts, June 22.

Claim.—"I claim the arrangement of the spiral slots, or spark arresters, in combination with the cylinder and guard, in the manner and for the purpose above set forth."

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26. For a *Machine for Turning Boot Legs;* Joseph H. Sandford, Hopewell, New York, June 22.

We are under the necessity of omitting this claim, as it could not be understood without drawings.

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27. For an *Improvement in the Gas Meter;* C. F. Brown, Baltimore, Maryland, June 22.

We omit this claim for the same reason as the previous one.

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28. For an *Improvement in the Furnace for Smelting Pig or Scrap Iron;* John C. McManaway, Scioto, Ohio, June 22.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the addition of a door, or doors, to a close fire run-

out, or refinery, whereby access can at any time be had to the interior, and the bottom renewed or repaired, or large chunks of iron put in, or for any other purpose, without the necessity of removing or deranging any other part of the furnace."

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29. For an *Improvement in the Cultivator;* Barnabas Langdon, Troy, New York, June 22.

Claim.—"What I claim and desire to secure by letters patent, is the standard, with its wings, as above described, and in combination therewith I claim the angular double share, or weed cutter, and the portable mould-boards; and also the upright cutters, with the plates to which they belong, all as above described."

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30. For an *Improvement in Drawers for Furniture;* Oliver Jenkins, Boston, Massachusetts, June 22.

Claim.—"Having thus described my invention, I shall claim constructing the bottom of the drawer with a groove in its centre, running from the front to the rear of the same, and the frame or case thereof, with a tongue which shall correspond to said groove, as set forth, and which, when the drawer is inserted in the case, shall enter the groove, and guide the drawer in its movements to and fro, the whole being arranged substantially in the manner and for the purposes herein above explained."

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31. For an *Improvement in the Plough Beam;* Joel Houghton, Ogden, New York, June 22.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is constructing the beam of a plough in parts, or, in other words, to throw it apart, or into parts, centrally, so as to increase the strength of the plough beam, without increasing the weight in proportion—the manner of attaching the cutter to it, and the mode of fastening the beam and standard together, thus doing away the clogging of the plough and the perishableness of the beam."

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32. For an *Improvement in the Bee Palace;* Henry Hiser, Wooster, Ohio, June 27.

Claim.—"What I claim as constituting my invention, and which I desire to secure by letters patent, is the combining with the respective compartments, a central, vertical opening, around which opening the respective compartments are situated, there being apertures from said compartments leading into, and from, said vertical opening, which apertures are governed by slides, in the manner and for the purpose set forth.

"I also claim, in combination with said central, vertical opening, the manner in which I have arranged and combined the several apertures and slides, by which a communication is established, or cut off, between any part of the structure; the whole being constructed sub-

stantially in the manner set forth, whilst such variations may be made therein, as may be dictated by fancy or convenience, whilst the distinguished features above claimed remain unchanged."

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33. For an *Improvement in the Steam Generator;* I. N. Lesh, S. W. Lesh, J. Deardorff, and Z. Beeson, Hagerstown, Indiana, June 27.

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is the combination of the spiral tubular generator and receiver, with the furnace and reflector, as described."

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34. For *Improvements in Melting and Rendering Tallow and other concrete fatty substances;* L. Montrop, Baltimore, Maryland, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combined use of the steam, introduced into the kettle in which the tallow is melted, and around it between the kettles, thus melting the tallow under high pressure, in the manner above described. I also claim, in combination with this apparatus, the hot well, constructed and arranged as herein set forth."

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35. For an *Improvement in the Cooking and Heating Stove;* Andrew Walker, Jr., Unity, New Hampshire, June 27.

Claim.—"I claim as my invention, and ask a patent for the combination of a gas generating apparatus, with a stove, in the manner, and by the method, structure, and arrangement of its parts, as above described."

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36. For *Improvements in the Power Looms for Weaving Carpets;* Thomas Flint, Boston, Massachusetts, June 27.

Claim.—"I claim the forming and using of two or more race ways on one race beam, in combination with two or more shuttle boxes at each end of said beam, one in the rear of the other; and this I claim whether one or more of these boxes be made to receive two or more shuttles, and to rise and fall vertically, for that purpose, and whether the cylindrical shuttle box herein described, be employed or not; the division between said races being formed by means of a comb, the teeth, needles, or points of which are alternately raised and retracted, substantially in the manner and for the purpose set forth. I am aware that a comb furnished with teeth or needles, and operated in a manner somewhat resembling that above described, has been used in looms for weaving what is denominated lapped goods—the needles or teeth being employed in this case, to protect the goods from the action of the shuttles in their passage along the race, but not forming, thereby, a double race, as in my loom. I do not therefore claim the use of said comb or needles, excepting in combination with my double race, furnished with shuttle boxes, one behind another, as set forth.

"I claim the manner of rotating and vibrating the cylindrical shuttle box, by means of the chain wheels, levers, ratchet wheels, sliding

frame and sliding rods connected with the Jacquard machine, and with each other, so as to co-operate in producing the desired effect, as set forth."

MECHANICS, PHYSICS, AND CHEMISTRY.

*Objections to the Theories severally of Franklin, Dufay, and Ampere, with an effort to explain Electrical Phenomena, by Statical, or Undulatory, Polarization.** *By* ROBERT HARE, M. D., *Emeritus Professor of Chemistry in the University of Pennsylvania.*†

1. It appears from the experiments of Wheatstone, that the discharge of a Leyden jar, by means of a copper wire, takes place within a time so small, that were the transfer of a fluid from the positive to the negative surface requisite for its accomplishment, a current having a velocity exceeding two hundred thousand miles in a second would be necessary.

2. The only causes for the velocity of an electric current, according to Franklin, are the repulsion between the particles of the electric fluid, of which it has been assumed to consist, and the attraction between those particles and other matter. These forces are alleged to concur in distributing the supposed fluid throughout space; whether otherwise void, or partially occupied by conducting solids or fluids. Hence, when between two or more spaces, surfaces, or conducting masses, there is an unequal distribution of the electric fluid, the equilibrium is restored whenever a communication is opened, by means of a sufficiently conducting medium. Agreeably to this view of the subject, there seems to be a resemblance between the supposed effort of the electrical fluid to attain a state of equable diffusion, and that which would exist in the case of a gas confined in adjoining receivers, so as to be more dense within one than within the other; for, however the subtility of the supposed electric fluid may exceed that of any gas. there seems to be an analogy as respects the processes of diffusion which must prevail. But on opening a communication between cavities in which any aëriform fluid exists, in different degrees

* Agreeably to Faraday's researches, and general experience, we have reason to believe that all particles of matter are endowed with one or the other of two species of polarity. This word polarity conveys the idea that two terminations in each particle are respectively endowed with forces which are analogous, but contrary in their nature; so that of any two homogeneous particles, the similar poles repel each other, while the dissimilar attract; likewise when freely suspended they take a certain position relatively to each other, and on due proximity, the opposite polar forces, counteracting each other, appear to be extinct. When deranged from this natural state of reciprocal neutralization, their liberated poles react with the particles of adjacent bodies, or those in the surrounding medium. Under these circumstances, any body which may be constituted of the particles thus reacting, is said to be polarized, or in a state of polarization.

† Read before the Academy of Natural Sciences, and with their permission published in the Medical Examiner: republished with corrections and additions by the author.

of condensation; evidently the density will diminish within one cavity and will augment within the other with a rapidity, which, however great at the commencement, must decrease and become evanescent with the diversity of condensation to which it owes its existence. Far from taking place in an analogous manner, electrical discharges are effected with an extreme suddenness, the whole of the redundancy being discharged at once, in a mode more like the flight of a bullet, projected with infinite velocity, than that of a jet varying in celerity from a maximum to a minimum.

3. So far, in fact, is an electrical discharge from displaying the features which belong to the reaction of a condensed elastic fluid, that agreeably to the observations of our distinguished countryman Henry, the result is more like the vibrations of a spring, which, in striving to regain its normal position, goes beyond it. The first discharge between the surfaces of a Leyden jar is not productive of a perfect equilibrium. The transfer of different polarities goes beyond the point of reciprocal neutralization, producing a state, to a small extent, the opposite of that at first existing; and hence a refluent discharge ensues, opposite in direction to the primary one. But even this does not produce an equilibrium, so that a third effort is made. These alternate discharges were detected by means of the magnetism imparted to needles exposed in coils of copper wire.*

4. Supposing one or more rows of electrical particles, forming such a filament of electricity as must occupy the space within a wire of great length, to be made the medium of discharge to a Leyden jar; agreeably to the hypothesis of one fluid, the electrical filament must be attracted at one end of the wire, and propelled at the other, as soon as its terminations are brought into due communication with the coatings of the jar. Yet the influence of the oppositely charged surfaces of the jar, cannot be conceived to extend to those portions of the electricity which are remote from the points of contact, until they be reached by a succession of vibrations. Hence it is inconceivable, that every particle in the filament of electric matter can be made at the same time to move, so as to constitute a current having the necessary velocity and volume to transfer, instantaneously, the electricity requisite to constitute a charge. Even the transmission of the impulses, in such an infinitesimal of time, seems to be inconceivable.

5. In reply to these objections, it has been urged by the Franklinians, that a conductor being replete with electricity, as soon as this fluid should be moved at one end, it ought to move at the other. This might be true of a fluid if incompressible, but could not hold good were it elastic. A bell wire moves at both ends when pulled only at one; but this would not ensue were a cord of gum elastic substituted for the wire.

6. But if the flow of one fluid, with the enormous velocity inferred, be difficult to conceive, still more must it be incomprehensible that two fluids can rush with similar celerity, from each surface of the jar, in opposite directions, through the narrow channel afforded by a wire; especially as they are alleged to exercise an intense affinity; so that it

* Communicated to the American Philosophical Society.

is only by a series of decompositions and recompositions that they can pass each other. That agreeably to the theory of Dufay, equivalent portions of the resinous and vitreous fluids must exchange places during an electrical discharge, will appear evident from the following considerations:

7. One surface being redundant with vitreous and deficient commensurately of resinous electricity, and the other redundant with the resinous and deficient of the vitreous fluid, it is inevitable that to restore the equilibrium, there must be a simultaneous transfer of each redundancy to the surface wherein there is a deficiency of it to be supplied. If after decomposing a large portion of the neutral compound previously existing on the surfaces of the jar, and transferring the ingredients severally in opposite directions, so as to cause each to exist in excess upon the surface assigned to it, were the redundancies, thus originated, to be neutralized by meeting in the discharging rod, neither surface could recover its quota of the electrical ingredient of which it must have been deprived agreeably to the premises.

8. This calls to mind the fact, that no evidence has been adduced of the existence of any tertium quid, arising from the union of the supposed electricities, founded on any property displayed by their resulting combination in the neutral state. It must, if it exist, constitute an anomalous matter, destitute of all properties, and of the existance of which we have no evidence, besides that founded on the appearance and disappearance of its alleged ingredients.

9. But however plausibly the discharges consequent to making a conducting communication from one electrified mass or surface to another mass or surface in an opposite state, may be ascribed to accumulations either of one or of two fluids; neither according to one theory nor the other, is it possible to account satisfactorily for the stationary magnetism with which steel may be endowed, nor the transitory magnetism, or dynamic power of induction, acquired by wires transmitting galvanic discharges.

10. For the most plausible effort which has been made for the purpose of reconciling the phenomena of electro-magnetism with the theory of two fluids, or with that of one fluid, so far as these theories are convertible, we are indebted to Ampere.

11. According to the hypothesis advanced by this eminent philosopher, the difference between a magnetized and an electrified body is not attributable to any diversity in the imponderable matter to which their properties are respectively due, but to a difference in the actual state or distribution of that matter. Statical polarity is the consequence of the unequal distribution of the two electric fluids whose existence he assumes; while magnetical polarity is the consequence merely of the motion of those fluids, which, in magnets, are supposed to gyrate in opposite directions about each particle of the mass. These gyrations are conceived to take place only in planes at right angles to the axis of the magnet; so that in a straight magnet, the planes of the orbits must be parallel to each other.*

* The words gyration, vortex, and whirl, are considered as synonymous, and used indifferently to avoid monotony.

12. The aggregate effect of all the minute vortices of the electrical fluids, in any one plane, bounded by the lateral surfaces of the magnet, is equivalent externally to one vortex, since, in either case, every electric particle on that surface will so move as to describe tangents to a circle drawn about the axis of the magnet. When the electrical vortices of the pole of one magnet conflict in their direction with those of another, as when similar magnetic poles are approximated, repulsion ensues; but if the vortices are coincident in direction, as when dissimilar poles are near, attraction takes place. When a current through a galvanized wire * concurs in direction with the magnetic vortices as above described, attraction ensues; repulsion resulting when it does not so concur. Hence, the magnet, if movable, will strive to assume a position in which its electrical currents will not conflict with those of the wire on one side more than on the other: also the wire, if movable, will tend so to arrange itself as to produce the same result, which can arrive only when the needle is at right angles to the wire, and its sides consequently equi-distant therefrom.

13. Electric currents will produce magnetic vortices, and, reciprocally, magnetic vortices will produce electric currents. Hence the magnetism imparted to iron by galvanized spirals, and the Faradian currents produced by magnetized iron within spirals not galvanized.

14. Ampere's theory has, in a high degree, the usual fault of substituting one mystery for another; but, on the other hand, it has, in an equally high extent, the only merit to which any theory can make an indisputable claim: I mean that of associating facts so as to make them more easy to comprehend and to remember, enabling us, by analogy, to foresee results, and thus affording a clue in our investigations. Evidently, the author of this theory was guided by it, in his highly interesting and instructive contrivances; and Professor Henry ascribes his success in improving the electro-magnet, to the theoretic clue which he had received from Ampere.

15. Nevertheless, the postulates on which this Amperian hypothesis is founded, appear to me unreasonable. They require us to concede that about every atom of a permanent magnet a process is going on, analogous to that generally admitted to exist in a galvanic circuit, where two fluids pass each other in a common channel by a series of decompositions and recompositions. In the galvanic circuit this process is sustained by chemical reaction; but without any co-enduring cause, how is it to be sustained permanently in a magnet? Is it reasonable to assume that the heterogeneous constituents of an imaginary tertium quid are perpetually separating only to re-unite?

16. In cases of complex affinity, where four particles A B C D are united into two compounds A B, C D, it is easy to conceive that, in obedience to a stronger affinity, A shall combine with C, and B with D: but, without any extraneous agency, wherefore, in any one compound, should a particle A quit one particle B, in order to unite with

* I consider a wire as galvanized, when it is made the medium of the discharge from a galvanic battery.

another particle of the same kind; or wherefore should any one, B, quit one A, in order to combine with another A.

17. That such a process should take place in consequence of the inductive agency of a similar process already established in a magnet or galvanized wire were difficult to believe: but it would seem utterly incredible that the most *transient* influence of such induction, should be productive of such permanent electrolytic gyration as has been above specified. Moreover, it is inconceivable that the particles of any matter should, as required by this hypothesis, *merely by being put into motion*, acquire a power of reciprocal repulsion, or attraction, of which it were otherwise destitute.

18. The vortices being assumed to take place about each atom, cannot severally occupy an area of greater diameter than can exist between the centres of any two atoms. Of course, the gyratory force exercised about the surface of a magnet by the aggregrate movements of the vortices, cannot extend beyond the surface more than half the diameter of one of the minute areas of gyration alluded to. Wherefore, then, do these gyrations, when similar in direction, from their concurrence approach each other; when dissimilar in direction from contrariety, move away, even when situated comparatively at a great distance?

19. I should consider Ampere's theory as more reasonable, were it founded upon the existence of one fluid; since, in that case, vortices might be imagined without the necessity of supposing an endless and unaccountable separation and reunion of two sets of particles; not only devoid of any property capable of sustaining their alleged opposite gyrations, but actually endowed with an intense reciprocal attraction which must render such gyrations impossible. But even if grounded on the idea of one fluid, this celebrated hypothesis does not seem to me to account for the phenomena which it was intended to explain. If distinct portions of any fluid do not attract or repel each other when at rest, wherefore should they either attract or repel each other when in motion. Evidently mere motion can generate neither attraction nor repulsion. Bodies projected horizontally gravitate with the same intensity, and consequently, in any given time, fall to the earth through the same perpendicular distance, whether moving with the celerity of a cannon ball, or undergoing no impulse excepting those arising from their own unresisted weights.

20. The objections which are thus shown to be applicable in the case of liquids, of which the neighboring particles are destitute of the reaction requisite to produce the phenomena requiring explanation, must operate with still greater force when ethereal fluids are in question, of which the properties are positively irreconcilable with the phenomena. According both to Franklin and Dufay, bodies, when similarly electrified, should repel each other: yet in point of fact, collateral wires, when subjected to similar voltaic discharges, and of course similarly electrified, become reciprocally attractive, while such wires, when dissimilarly electrified by currents which are not analogous, become reciprocally repulsive.

21. Agreeably to Ampere, an iron bar, situated within a coil of

wire subjected to a galvanic current, is magnetized, because the current, in the wire, is productive of an electrical whirlpool about every particle of the metal. When the iron is soft, the magnetism, and of course the gyrations of which its magnetism consists by the premises, cease for the most part as soon as the circuit through the coil is broken; but when the iron is in the more rigid state of hardened steel, the gyrations continue for any length of time after the exciting cause has ceased.

22. This theory does not explain wherefore the hardening of the steel should cause the gyration to be more difficult to induce yet more lasting when its induction is effected. Evidently the metallic particles must take some part in the process; since it is dependent, for its existence and endurance, upon their nature and their state. Yet no function is assigned to these particles. In fact, it is inconceivable, either that they can participate in, or contribute to, the supposed gyration.

23. The electrical fluid in an iron bar, cannot form a vortex about each particle, all the vortices turning in one direction, without a conflict between those which are contiguous. In order not to conflict with each other, the alternate vortices would have to turn in different directions, like interlocking cog-wheels in machinery. But in that case, if magnetism be due to currents, the magneto-inductive influence of one set would neutralize that of the other. Again, how can a current, excited by a battery in one circuitous conductor, cause, by dynamic induction, a current in the *opposite direction*, through another conductor parallel to the first, but insulated therefrom? How can a current of quantity in a ribbon coil, give rise to one of intensity in a coil of fine wire, rushing of course with a velocity commensurate with the intensity thus imparted?

24. From the preceding considerations, and others which will be stated, it follows, that it has been erroneously inferred that the only difference between galvanic and frictional electricity is dependent on quantity and intensity. It must be evident that there is a diversity in the nature of these affections of matter, sufficient to create a line of demarcation between them.

25. Having stated my objections to the electrical theories heretofore advanced, it may be proper that I should suggest any hypothetical views which may appear to me of a character to amend or supersede those to which I have objected. But however I may have been emboldened to point out defects which have appeared to me to be inherent in the theories heretofore accredited, I am far from presuming to devise any substitute which will be unobjectionable. I am fully aware that there is an obscurity as respects the nature and mutual influence of chemical affinity, heat, light, electricity, magnetism and vitality, which science can only to a minute extent dispel.

26. The hypothesis which I now deem preferable, is so much indebted to the researches and suggestions of Faraday and others, that, were it true, I could claim for myself but a small share of the merit of its origination. That sagacious electrician employs the following

language: "*In the long continued course of experimental inquiry, in which I have been engaged, this general result has pressed upon me constantly, namely, the necessity of admitting two forces or directions of force, combined with the impossibility of separating these two forces or electricities from each other.*"—*Experimental Researches*, 1163.

27. Subsequently (1244) after citing another proof of the inseparability of the two electrical forces, he alleges *it to* "*be another argument in favor of the view that induction and its concomitant phenomena depend upon* a polarity of the particles of matter!"

Supposed grounds for a Theory.

28. The grounds upon which I venture to advance a theory, are as follows:—

"The existence of two heterogeneous polar forces acting in opposite directions, and necessarily connate and co-existent; yet capable of reciprocal neutralization, agreeably to the authority of Faraday and others: the polarity of matter in general, as displayed during the crystalization and vegetation of salts: also as made evident by Faraday's late researches, and the experiments and observations of Hunt: the very small proportion of the space in solids, as in the instance of potassium and other metal, which can be occupied by the ponderable atoms; while agreeably to the researches and speculations of Faraday (rightly interpreted), the residual space must be replete with imponderable matter. The experiments and inferences of Davy and others, tending to sanction the idea that an imponderable ethereal fluid must pervade the creation: the perfect identity of the polarizing effects, transiently created in a wire by subjection to a galvanic discharge, with those produced by the permanent polarizing power of a steel magnet: the utter heterogeneousness of the powers of galvanic and frictional electricity, as respects ability to produce sparks before contact, and likewise of the polarities which they respectively produce: the sounds observed severally, by Henry and Mairran, as being consequent to making and breaking a galvanic circuit through a conductor, or magnetizing or demagnetizing by means of surrounding galvanized coils."

Proofs of the existence of an enormous quantity of Imponderable Matter in Metals.

29. It has been most sagaciously pointed out by Faraday, that four hundred and thirty atoms which form a cube of potassium in the metallic state must occupy nearly six times as much space as the same number of similar atoms fill, when existing in a cube of hydrated oxide of potassium of the same size; which, besides seven hundred metallic atoms, must hold seven hundred atoms of hydrogen and fourteen hundred of oxygen, in all two thousand eight hundred atoms; whence it follows that, in the metallic cube, there must be *room* for six times as many atoms as it actually holds.

30. With all due deference, I am of opinion that this distinguished philosopher has not been consistent in assuming that, agreeably to the

Newtonian idea of ponderable atoms, the space in potassium not replete with metal must be vacant; since, according to facts established by his researches, or resulting therefrom, an enormous quantity, both of the causes of heat and of electricity, exists in metals. Moreover, agreeably to his recent speculations, those causes must consist of material, independent, imponderable matter, occupying the whole of the space in which their efficacy is perceptible. To the evolution of the imponderable matter thus associated, the incandescence of a globule of potassium on contact with water, may be ascribed, since it is the consequence of the displacement of such matter by the elements of water, which, in replacing it, converts the metal into the hydrated oxide called caustic potash.

31. The existence both of the causes of electricity and heat in metals, is likewise confirmed by the fact, that the inductive influence of a magnet is sufficient to cause all the phenomena of heat, electrolysis, and magnetism, as exemplified by the magneto-electric machine. The existence of the cause of heat in metals is also evident from the ignition of an iron rod when hammered, or the deflagration of wire by the discharge of a Leyden battery.

32. The superiority of metals as electrical conductors, may be the consequence of the pre-eminent abundance of imponderable matter entering into their composition, as above alluded to in the case of potassium.

33. Graham, in his Elements, treating of electricity, alleges that the "great discoveries of Faraday have completely altered the aspect of this department of science, and suggests that all electrical phenomena whatever involve the presence of matter." Unless the distinguished author, from whom this quotation is made, intended to restrict the meaning of the word matter to ponderable matter, there was no novelty in the idea that electrical phenomena involve the presence of matter, since the hypotheses of Franklin and Dufay assume the existence of one or more imponderable material fluids. But, on the other hand, if the meaning of the word *matter* is only to comprise that which is ponderable, the allegation is inconsistent with the authority cited. According to the researches of Faraday, there is an enormous electrical power in metals, and according to his speculations, such powers must be considered as imponderable material principles, pervading the space within which they prevail, independently of any ponderable atom acting as a basis for material properties; the existence of such atoms being represented as questionable.

Electrical Phenomena attributed to Stationary, or Undulatory, Polarization.

34. It having been shown that in electrical discharges there cannot reasonably be any transfer of matter, so as to justify the idea of their being effected either by one current or by two currents, the only alternative seems to be that the phenomena are due to a progressive affection of the conducting medium, analogous in its mode of propagation to waves, as in the case of liquids, or the aërial or ethereal undulations to which sound and light are ascribed. (1, 2, 3, &c., &c.)

35. The idea intended to be conveyed by the word wave, as applied in common to the undulatory affections above mentioned, and that which is conceived to be the cause of the phenomena usually ascribed to one or more electrical currents, requires only that there should be a state of matter, which, while it may be utterly different from either of those which constitute the waves of water, light, or sound, may, nevertheless, like either, pass successively from one portion of a mass to another.

36. The affection thus designated may be reasonably distinguished from other waves, as a *wave of polarization*, since the wire acts, so long as subjected to the reiterated discharges of a voltaic series, as if it were converted into innumerable small magnets, situated like tangents to radii proceeding from its axis.

37. But if a polarizable medium be requisite to electrical discharges, since they pass through a space when devoid of *ponderable* matter, there must be some *imponderable* medium through which they can be effected. Hence we have reason to infer that there is an imponderable matter existing throughout all space, as well as within conductors, which is more or less the medium of the opposite waves essential to electric discharges. Quoting his own language, Davy's experiments led him to consider "that space, (meaning void space,) where there is not an appreciable quantity of this matter, (meaning ponderable matter,) is capable of exhibiting electrical phenomena:" also that such phenomena "are produced by a highly subtile fluid or fluids." Moreover, that "it may be assumed, as in the hypothesis of Hooke, Euler, and Huygens, that an ethereal matter susceptible of electrical affections fills all space."

38. Agreeably to the suggestions above made, all ponderable matter which is liable to be electrified *internally* by electrical discharges, may be considered as consisting of atoms composed of imponderable ethereo-electric particles in a state of combination with ponderable particles, analogous to that which has been supposed to exist between such particles and caloric when causing expansion, liquidity, or the aëriform state. Atoms so constituted of ethereal and ponderable particles, may be designated as ethereo-ponderable atoms.*

39. A quiescent charge of frictional electricity, only affecting the superficies of any ponderable mass with which it may be associated, and having no influence upon the component ethereo-ponderable atoms severally, is not to be ascribed to redundancies or deficiencies of the ethereal matter, but to different states of polarization produced in different sets of the particles of such matter existing about the

* Pouillet suggests that when the passage of a ray of light through glass, is influenced by a powerful magnet, agreeably to the experiments of Faraday, "consistently with the undulatory theory of light, it is the ether of the body submitted to the experiment, which would be modified by the magnetism, and that it would be very difficult to recognise whether it is modified without any participation of the ponderable matter with which it is so intimately connected." Thus the existence of matter, composed of ethereal as well as ponderable particles, is sustained by all the evidence which has been brought to uphold the undulatory theory of light.—*L. E. & D. Phil. Mag. &c. for* 1846, *Vol.* 28*th, page* 335.

electrifiable bodies.* During the action of an electrical machine, these particles are polarized by the opposite polarities transiently induced in the surfaces subjected to friction; one set of particles going with the electric, the other remaining with the rubber.

40. The particles thus oppositely polarized, severally divide their appropriate polarities with other ethereal matter surrounding the conductors, and this, when insulated, is retained until a further polarization results from the same process. Thus are the ethereo-electric atmospheres respectively surrounding the positive and negative conductors oppositely polarized, and consequently charged to the degree which the machine is competent to induce. Under these circumstances, if a rod be made to form between them a conducting communication, by touching each conductor with one of its ends, the polarities of the ethereo-electric atmospheres by which they are severally surrounded, propagate themselves, by a wave-like process, over, and more or less through, the rod, according to its nature and dimensions, so as to meet midway, and thus produce reciprocal neutralization.

41. When the oppositely polarizing waves, generated by friction, as above described, are by means of a conducting communication transmitted to the surfaces of a coated pane, the two different portions of the electro-ether, there existing, are severally polarized in opposite ways, one being endowed with the properties usually called vitreous, or positive, the other with those usually called resinous, or negative. In fact, the two polarized atmospheres thus created, may be conveniently designated as the "*two electricities*," and alluded to in the language heretofore employed in treating of phenomena, agreeably to the hypothesis which assumes the existence of heterogeneous fluids, instead of heterogeneous polarities.

42. Of course it will follow, that the oppositely polarized ethereal atmospheres thus produced, one on each surface of the electric which keeps them apart, must exercise towards each other an attraction perfectly analogous to that which has been supposed to be exercised by the imaginary heterogeneous electric fluids of Dufay. The electro-ether† being elastic, a condensation over each of the charged

* The word statical, has been used to designate phenomena which are the effects of electricity when at rest, as when accumulated upon conductors or the surfaces of panes or jars.* Phenomena which are supposed to arise from electricity in motion (forming a current), are designated as dynamic. Thus when charging one side of a pane, produces the opposite state in the other, the effect upon the latter is ascribed to *statical* induction; but when a discharge of electricity through one wire, causes a current in another, forming an adjacent circuit, the result is ascribed to *dynamic* induction. This method of designation is employed whether the alleged current be owing to electricity generated by friction, as in the case of a machine, or generated by chemical reaction, as in the case of a galvanic battery. A good word is wanting to distinguish electricity, when produced by friction, from electricity produced by galvano-chemical reaction: for want of a better, I will resort to that employed by Noad *(frictional)*, which has the advantage of being self-explanatory.

† As the word ether is used in various senses, the syllables "*electro*" being prefixed, serve to designate that which is intended.

* See my Compendium for Treatise on Electricity, pages 26—29.

surfaces, proportionable to the attractive force, must ensue; while over the surface of an electrified conductor, the similarly polarized atoms not being attracted by those in an oppositely polarized atmosphere beneath the surface, tend, by their reciprocally repulsive reagency, to exist further apart than in a neutral state. Hence, the electro-ether, as it exists over the surface of an insulated conductor, is rendered rarer, while, as existing over the surfaces of charged panes or Leyden jars, it must be in a state of condensation.* And, consequently, while the space perceptibly electrified by the charge of a conductor, for equal areas and charging power, is much more extensive than the space in which the charge of a coated pane is perceptible, the striking distance being likewise much greater; yet upon any body successively subjected to a discharge from each, the effect will be more potent when produced by means of the pane.

Ignition, Electrolysis, and Magnetism, Secondary Effects of Frictional Discharges; or, in other words, of Polarizing Electro-ethereal Waves.

43. In proportion as a wire is small in comparison with the charge which it may be made the means of neutralizing, the conducting power seems to be more dependent on the sectional area,† and less upon the extent of surface. The reciprocal repulsion of the similarly polarized ethereal particles must tend always to make them seek the surface, but at the same time their attraction for the ethereo-ponderable particles composing the wire has the opposite effect, and tends to derange these from their normal polar state of quiescence. Commensurate with the extent in which this state is subverted, is the resulting heat, electrolytic power, and electro-magnetic influence. The phenomena last mentioned, are, however, secondary effects consequent to the participation of the ethereo-ponderable matter in the undulations resulting from the statical discharge.

44. Such effects, making allowance for the extreme minuteness of the time occupied by the process, are probably, in all cases, proportional to the degree in which the ponderable matter is affected, up to the point at which it is dissipated by deflagration; but the duration of a statical discharge being almost infinitely minute for any length of coil which can conveniently be subjected thereto, the electro-magnetic and other effects of a statical discharge, are not commensurate with the intensity of the affection of the wire.

45. There is, in fact, this additional reason for the diversity between the electro-magnetic power of a statical discharge, as compared with that of the voltaic series: any wire which is of sufficient length and tenuity to display the maximum power of deflagration by the former, cannot serve for the same purpose in the case of the latter. Moreover, the form of a helix closely wound, so that the coatings may

* See my communication on "*Free Electricity*," in Silliman's American Journal of Science, Vol. III., New Series, number for May, 1847.

† The sectional area of a conductor is the area of the superficies which would be exposed by cutting it through at right angles to its axis.

touch, which is that most favorable for the reiteration of the magnetic influence of the circuit upon an iron rod, cannot be adopted in the case of statical discharges of high intensity, since the proximity of the circumvolutions would enable the ethereal waves, notwithstanding the interposition of cotton or silk, to cross superficially from one to the other, parallel to the axis of the included iron, instead of pursuing the circuitous channel afforded by the helix with the intensity requisite to the polarization of the ponderable atoms.

(To be Continued.)

A Plan for Obtaining Pure Water from the Atmosphere, for the Supply of Vessels at Sea, and other purposes. By JOHN THOMSON.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Gentlemen: — Considering the necessity of water, as drink, to the existence of man, and that much real suffering and death has occurred upon the open ocean, from the want of it, I beg leave to express my fixed opinion, that pure water for drink may be extracted from the atmosphere, in a sufficient quantity to be of some service to the maritime community, and at a sufficiently cheap rate to warrant a trial upon a large scale. My researches and experiments prove satisfactorily that the atmospheric air of every climate is more or less charged with watery vapor, according to its temperature and locality, holding in solution from $\frac{1}{3}\frac{1}{0}$ to $\frac{1}{3}\frac{1}{0}\frac{1}{0}$ part, by weight, of water—that a cubic foot of air at 66° is capable of holding in solution about 8 grains of water—that the capacity of air for holding water increases with the temperature—and that in a tropical climate, and over the ocean, it is at all times nearly saturated with vapor. This water, which is chemically combined with the air, shows itself at all times, when subjected to a diminished temperature, independent of electricity—and hence we have dews, fogs, rain, &c., under the operations of nature. But that which must strike the attention of every person, and which proceeds from the same cause, is the drops of water that collect upon the outside of a jug of cold water on a warm summer day.

I am well aware of the process of distilling sea water, which has long been practised with tolerable success, but fuel is not always to be had; neither is the drink thus obtained, as pure as could be wished.

I have never met with any proposal for obtaining fresh water artificially, at sea, without the expense of chemicals. The plan which I am about to propose, has such advantage, and may nevertheless go under the designation of distillation, although I dispense with fire; for I propose to condense the warm air of the atmosphere by the cold water of the ocean. I have attended to the temperature of the air in different latitudes, as also to its humidity and the dew point. I have likewise observed the degrees of heat that characterize the waters of a tropical sea from others more remote from the equator, and the depths at which a given temperature of the ocean may be had, together with the currents which circulate both the ocean and the atmosphere of the globe—all of which shows much intelligence and

labor in the experimentalists in these various branches of natural philosophy. But still I have to regret a want of experiments for the temperature of the ocean at smaller depths; although I find, from the many experiments that have been made by soundings, that there is a degree of cold in the ocean, (though at very great depths,) far beyond what is necessary for my purpose as a condensing medium, the obtaining of which at the surface, seems to me the only point at issue to crown my undertaking with success. Pursuing this one point, I find that the currents of the ocean, in sweeping along the bottom, are occasionally obstructed by banks, &c., which lift the cold waters up, and that even after mingling with the upper and warmer, the temperature is so much changed, that the thermometer was at one time seriously talked of as a necessary nautical instrument, for descrying danger when nearing land. The knowledge of hydraulics and hydrostatics emboldens me to say that a pipe could be let down from a float at anchor, over some well selected bank, reaching to a depth sufficient to bring up these bottom waters, and that the motion of the under current is amply sufficient to continue a circulation (as only a circulation, and not a lifting, of the waters is what is required) of the cold stream in the pipe, and through the machine, without the use of any other power—whilst a windsail could convey a continuous current of atmospheric air through the apparatus to be acted on by the water, as in a common distilling operation—the average velocity of the wind over the ocean being estimated at 18 miles per hour throughout the year.

In the summer of 1845, I instituted a series of experiments with a machine I had made, and with the results of which I was highly pleased; but other business interfering, I have never found it possible to renew my enquiries upon the subject. The worm with which I operated was of tin, a little over half an inch in diameter, and about 18 feet in length, having an inner surface of about 3¾ square feet. This pipe, being coiled, I set into a tub of water, the two ends extending above the surface. At each experiment the water in the tub was kept at a fixed temperature, and thus, with the worm immersed, we blew a current of air through the pipe, by means of a pair of common bellows. In this rude and laborious manner, we succeeded at all times in obtaining water from the atmosphere—the state of the *barometer* seemingly having no influence on this branch of philosophical enquiry. Some of these experiments were performed in the hot sunshine, and others in the shade.

I find from my notes, July 15, two trials. The condensing medium in the box was cooled by ice to 38°—the atmosphere being 83°. The produce of water, after working half an hour, was over half an ounce, or a good table-spoonful. Both trials were conducted under the same circumstances, and with equal results.

Again, August 10th—two experiments. The time of each operation was two hours. In the first, the condensing medium was spring water, at 54°, the atmosphere 77°—produce, $1\frac{5}{8}$ ounces of water. The air, after passing through the worm, was reduced to 61°, having lost 16°. Second experiment—Condensing medium reduced by ice, to 37°—atmosphere, 80°—produce, $2\frac{0}{16}$ ounces. The air at its exit, 49°,

having lost 31°. Thus, from these last two experiments, I remark that it is not *proportionately* advantageous to reduce the temperature of the air to a very low degree, in passing through the worm—for observe, in the last mentioned trial, I reduced the air about double of the former, and only received $\frac{11}{16}$ by so doing, which establishes a very material point regarding practical operations on a large scale, viz: that to extract a few degrees of heat from the air of a high temperature, yields over double of the same reduction of a lower temperature; and further, that a condensing medium, such as I propose, may be obtained, and that frigorific mixtures are of little service. I do not propose to extract all the vapor that may be contained in the current of air through the machine, but only that portion contained in the higher numbers in the scale of temperature. Although I have mentioned only a few of my many experiments, I hope it will be evident that the plan is practicable, and I mention with pride, the obtaining from the hot air, under a burning sun, a full tumbler of pure water, in four hours, whilst my pipe had only the limited surface of 3¼ square feet, together with the disadvantage of an inland situation, where the moisture is more limited than at sea.

It was my original design that each ship should carry its own apparatus for obtaining fresh water, but from the conflicting statements regarding the cold existing a few feet below the surface, I have discarded the idea, and now advocate with confidence the plan which I have submitted to you.

The various currents in the ocean are likely so to affect the object at which we aim, owing to their difference of temperature, that I pointedly urge a good selection of situation. To illustrate this difference, take the Equatorial and the Guinea currents, which run parallel, but in contrary directions, upwards of 1000 miles, and differ in their temperature 10° or 12°.

I might insert a table of temperatures for both the air and the water, for all the different latitudes, but I deem it superfluous. Suffice it that the mean temperature of the air, the year round, both day and night, between the tropics, varies from 85°, which is at the equator, to about 77° at about the latitude of the tropics, and that however the thermometer may range, it is more regular over the ocean, and never rises as high at sea as on the main land.

The temperatures of the waters of the ocean, although less known, are nevertheless found to vary considerably. In the tropical seas, as well as in the temperate zones, the temperature diminishes in a geometrical progression, while the depth is taken arithmetically, and although the waters of the sea, in any latitude, or in any season, cannot exceed 86°, yet the bottom has often been found between 30° and 40°.

In conclusion, I consider a detailed proposal for further operations, having for its object the production, reproduction, or manufacture of water from the atmosphere, for the use of the shipping interest navigating the warmer seas, as inadvisable upon my part. Modifications can be made of my simple apparatus, to an indefinite extent, by concentrate tubes within each other, or otherwise, whilst the float may be of any size, so as to supply the shipping as a watering place, safe

from hostile shores and circuitous routes, &c. I would only add, that if this should meet with a favorable reception, I will be happy to add anything further that may have occurred in my experiments, and omitted here.

Philadelphia, December, 1847.

A Description of Col. Long's Composite Bridge. Secured, March 10, 1845, *and Patented, November* 13, 1847.

The Composite Bridge is so called from the fact, or circumstance, that it comprehends the principles of the Brace and Suspension Bridges, patented in 1839, combined and rendered co-operative in the truss-frames of a single bridge, and is composed of two or more single, double, triple, or quadruple truss-frames, stayed, supported, and strengthened, by the aid of such transverse and lateral braces, arch braces, flooring, &c., &c., as may be deemed most suitable for these purposes. This bridge is distinguished from other bridges heretofore invented and now in use, by certain differences and combinations in the arrangements and operations of its parts, which will be duly considered in the specification.

Each truss-frame of the Composite Bridge comprises the following parts, all composed of timbers of uniform, or nearly uniform, transverse dimensions, varying from one to four inches in thickness, and from six to fifteen inches in width, their respective lengths being variable, according to the positions they respectively occupy in the truss-frames. These parts are as follows, viz:—strings and splices; main suspensor braces; posts or vertical ties; main thrust braces; brace bolsters, or brace gluts; brace keys, or wedges;—together with such arch braces; lateral and transverse braces; flooring; roofing; bolstering; trenailing, &c., as have heretofore been employed in bridge building, or may hereafter be deemed expedient in structures of this nature.

The strings and their splices are similar in all respects to those employed in the suspension bridge before mentioned. (See description, vol. xxiv., 2nd series, page 325.)

The main suspensor braces are inserted in the truss-frame, in the same manner as specified in the patent for the suspension bridge before alluded to; (see description, vol. xxiv, 2nd series, page 327;) but are so arranged in their connexion with other parts of the truss-frame, that they are enabled to act both by *tension* and by *thrust*, or by either of these forces, according to the stresses or actions to which the posts and main thrust braces of the truss frame, are subjected. These braces are so arranged that they may act alternately as main braces, and as counterbraces, according as the exigencies of the case, or the stresses upon the bridge may require the one or the other of these actions.

Note. The main suspensor braces may be rendered *contractile*, by introducing, in connexion therewith, splicing pieces, gibs, keys, &c., after the manner observed in the application of these parts to the splicings of the inferior arch braces of the brace bridge, except that they are so arranged as to reduce, instead of increasing, the length of the braces. (Pl. IV., fig. 2, vol. xxiv.)

The *posts* or *vertical ties*, instead of abutting against the strings as in the suspension bridge, or of being confined between the string pieces, by means of gibs and keys, as in the brace bridge, pass through and between the string pieces, as in the latter, and are confined by means of trenails, or other similar fastenings, passing through them and the strings. The posts occupy the same spaces between the string pieces, as those occupied by the suspensor braces, and have their extremities exteriorly of the strings, so scarfed and adjusted as to bring them respectively into close contact with the edges of the braces with which they are associated. Their operation is such as to keep the upper and lower strings of the truss frame at fixed distances asunder, obviating any and every tendency, whether to increase or diminish their distances.

Note. Whenever there is occasion to ensure and maintain the action by *tension* in the main suspensor braces (together with that by *thrust* in the main thrust braces) it is expedient to employ, in connexion with the posts, stretchers, composed of splicing pieces, gibs, and keys, &c., after the same manner as those employed in the inferior arch braces of the brace bridge, by means of which the distances between the upper and lower strings may be increased or diminished at pleasure, This arrangement contemplates merely the action of *thrust* in the posts, and not that of *tension*.

The main thrust braces occupy the relative positions assigned to the main braces in the specification of the brace bridge before cited. The parts of which each brace is composed are clamped together by means of trenails, or screw bolts and blocks, or gluts interwoven between the parts, in such a manner as to keep them all in their appropriate relative positions. The number of brace-pieces in each panel of the truss-frame, is the same as the number of string-pieces in each of the strings, instead of being the same as the number of spaces between the string-pieces; and instead of abutting against the posts, they abut against the string-pieces or brace bolsters; moreover, instead of being closely connected to the posts, by means of tuscums and shoulders, their extremities are rendered movable along the strings, by means of bolsters or gluts, and keys or wedges, whereby the trussing of the bridge is effected in a manner different from any method heretofore adopted for this purpose. The main thrust braces may be inserted in, or withdrawn from, the truss frame at pleasure.

Note I. Instead of the relative positions assigned, as above, to the main thrust braces, it is sometimes expedient to introduce these parts in a manner to extend diagonally through two or more panels, and to subserve the purpose of side arch braces, as well as those of main braces. The arrangement here contemplated, is such that two sets of braces may rise from the lower string, at and near the second post of the span, counting from the abutment or pier: one set extending through the second panel, and the other through the second and third panels from the abutment or pier; also, that two other sets may run in like manner, at and near the foot of the third post: one set extending through the third and fourth, and the other through the third, fourth, and fifth panels, from the abutment or pier. This arrangement is duly represented in the accompanying drawings. (See Pl. II., vol. ii, 3rd series, page 176.)

Note II. It is sometimes advisable to fortify the truss frames by inserting *extra braces*, especially in the first and second panels from the abutment or pier, in connexion with the main suspensor braces and the posts. The extra braces rise from the lower string about midway of the abutment or pier panel, or immediately back of the suspensor braces at their points of connexion with the lower string, cross the suspensor braces and the posts obliquely, and terminate at the lower side or edge of the string; the extremities of the extra braces abutting against the upper and lower strings. The extra braces may comprise the same number of parts as the main thrust braces, and may be confined in their places by means of trenails passing through them and the posts and suspensor braces, at the points of intersection of the latter, by the extra braces.

The brace bolsters are situated at the extremities of the main thrust braces, occupying a position between these extremities and two alternate angles of each panel of the truss frame, and serving as recipients of the thrust or action communicated by the main thrust braces. The length of the bolsters is at least equal to the horizontal thickness of each string. Their transverse section is in the form of a trapezoid, with two right angles at its back, and one oblique side opposite to the back. The base of the bolster is applied to the string, and its back to the post. The obliquity of the sloped side, is such as to form a right angle, or nearly a right angle, to the direction of the main thrust brace. On the back of each bolster, or the side applied to the post, recesses are formed in the bolster, adapted to the reception of keys or wedges, which are inserted between the edges of the post and bolster as a means of forcing the latter together with the end of the brace to slide along the string in a manner to subserve the trussing of the frame, and of imparting to it the requisite camber stiffness.

Instead of bolsters as just described, it may sometimes be advisable to use *brace gluts* as a means of trussing or straining the bridge. These are pieces of timber of the same width and thickness as the brace pieces, and two to four or five feet in length. The gluts are inserted between, and at each end of the brace pieces, protruding beyond the ends of the latter, far enough to reach nearly or quite through the string. They are firmly fixed in the braces by means of trenails passing entirely through them and the braces. Each glut is scarfed or sloped at its outer end, in such a manner as to admit a key or wedge between it and the edge of the post, by means of which the trussing and cambering of the truss frame may be effected as before.

The *brace keys*, or wedges, are inserted as before remarked, between the brace bolsters or gluts and the posts, and their adjustments may be such, as to admit of their being driven either upward or downward as circumstances may require. In general it will be found, that such adjustments as will admit of driving the lower keys downward, and the upper keys upward, will prove most convenient. The length of the keys, ordinarily, may vary from two to three feet. Their width must be equal to the thickness of the post or brace timbers;—and their thickness may be about an inch at the point and four inches at the butt. They may be sheathed, on their faces and heads, with sheet iron of any suitable thickness, if deemed proper.

The relations subsisting between the several parts above described, and the manner in which they are connected together, are clearly shown in the accompanying drawings, which together with the explanations thereof, are intended to form part of this specification.

The trenails, screw bolts, screws, &c., should be similar in size, shape, and dimensions, to those described in the patents of 1839, before cited; (see descriptions of brace and suspension bridges, vol. xxv, 2nd series, pages 325 to 331;) moreover the *lateral*, the *transverse*, and the *arch bracings*, of the bridge as also its *floorings*, its *roofings*, &c., &c., may be such as have been described in former patents, granted to Col. Long, or such as have been adopted in other methods of bridge building.

In constructing the composite bridge, it is advisable to keep the lower string as nearly straight as practicable, while to the upper string (both strings being applied and resting on the *framing ways*) it is deemed best to give a rising or crowning *camber* such as would result from a rise of about one inch at each successive post, counting from the abutment or pier, towards the centre of the bridge-span, varying the successive rises in such a manner as to produce a regular curve in the upper string, so that in a bridge span of twelve panels, the distance between the upper and lower strings will be about six inches greater at the centre, than at the extremities of the span. This distance will be increased or diminished in proportion as the span contains a greater or less number of panels than that above mentioned. The *camber* thus given will be somewhat increased when the trussing of the bridge shall have been effected by driving the brace keys intended for this purpose.

In further illustration of the composite bridge, the accompanying drawings, (see plate II,) and the following explanatory references are hereto annexed, and are to be regarded as part and parcel of this specification, to wit:

Fig. 1, Side view of one of the truss frames of the composite bridge, showing the manner of arranging and combining the several parts of which it is composed. N. B. The left half of this figure represents the manner of introducing the brace bolsters; and the right half, the manner of introducing the brace gluts.

Fig. 2, shows the manner of introducing the brace bolsters, together with their keys or wedges, also the manner of connecting the main suspensor braces, the posts, or vertical ties, and the main thrust braces, with the strings.

Fig. 3, Shows the manner of introducing the brace gluts together with their keys or wedges, &c., as in fig. 2.

Fig. 4, A side and end view of the brace bolster and its keys, projected into each other.

Fig 5, A side view of the glut, and its key, in connexion with the post and string.

Fig. 6, Side view of the string, post, main suspensor brace, main thrust brace with its glut and key, extra braces, trenails, &c.

Fig. 7, Same as in fig. 6, except that the brace bolster is substituted for the glut, and an arch brace has been added.

References to, and explanations of, the Parts represented in the Drawings above mentioned.

A A A. The strings of the truss frame composed of two or more pieces, together with the splicings as heretofore patented. (See Pl. IV. fig. 1., vol. xxiv.)

B B B. The main suspensor braces, each consisting of one or more pieces.

C C C. The posts or vertical ties, consisting of the same number of pieces as the main suspensor braces.

D D D. The main thrust braces. The number of pieces in each of these braces, exclusive of the bolsters or gluts, and trenails, may be the same as that of one of the strings.

a a a. The brace bolsters. *b b b.* The brace gluts.

c c c. The brace keys or wedges, *d d d.* The arch brace bolsters.

e e. The bridge bolster.

E E E. The extra braces and their positions with respect to other parts of the truss frame.

G G G. The inferior arch braces.

The places of the trenails, screw bolts, &c., are indicated in the drawings above considered, by small circles or dots. Moreover, the parts referred to in each of the figures, are represented in all cases by the same letter.

Having thus fully described the manner in which I construct my composite bridge,—I hereby declare that the improvements claimed by me as new therein, and which I desire to secure by letters patent, are the following, that is to say:

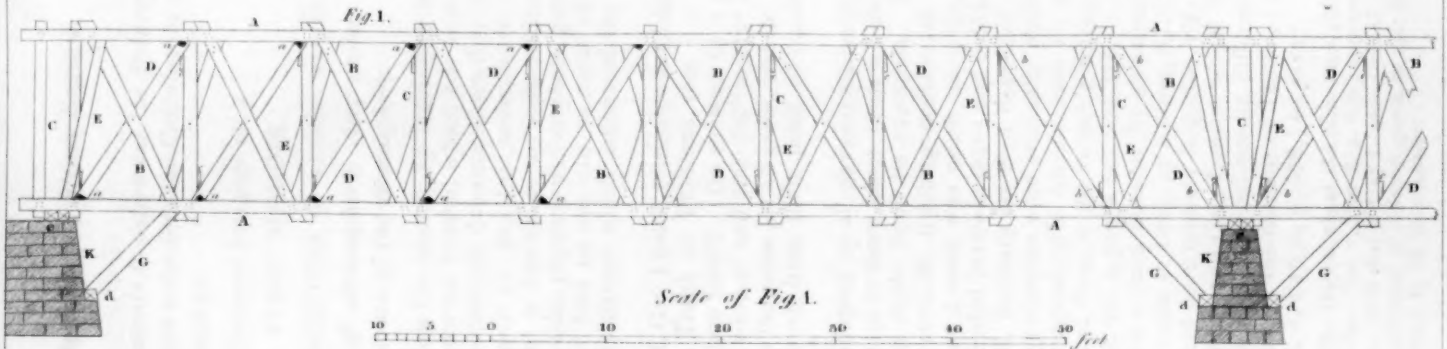
I claim as new, useful, and original, the method of trussing or straining the truss frames of bridges and other analogous structures, in the manner and by the means set forth, and described in the foregoing specification: that is, by inserting and driving keys or wedges between the posts or vertical ties, which are stationary, and the bolsters or gluts, which are movable; whereby the said bolsters, or the said gluts, together with the ends of the main thrust braces, may be made to slide along the strings, and the requisite trussing or straining is produced and imparted to the truss frames, without changing the relative positions of the strings, posts, or main suspensor braces.

I also claim as new, useful, and original, the application and use of the extra, or auxiliary braces, in connexion with the posts and main suspensor braces, and abutting against the string pieces, in the manner set forth and described in the said specification, for the purpose of strengthening, stiffening, and otherwise fortifying the truss frames of bridges.

The several arrangements and combinations of parts and principles contemplated in the foregoing specification and claims, together with the various actions and operations therein considered, are to be regarded as distinguishing features, or characteristics, of my composite bridge, as compared with those of all other bridges.

STEPHEN H. LONG.

(To be Continued.)



Scale of Fig. 1.

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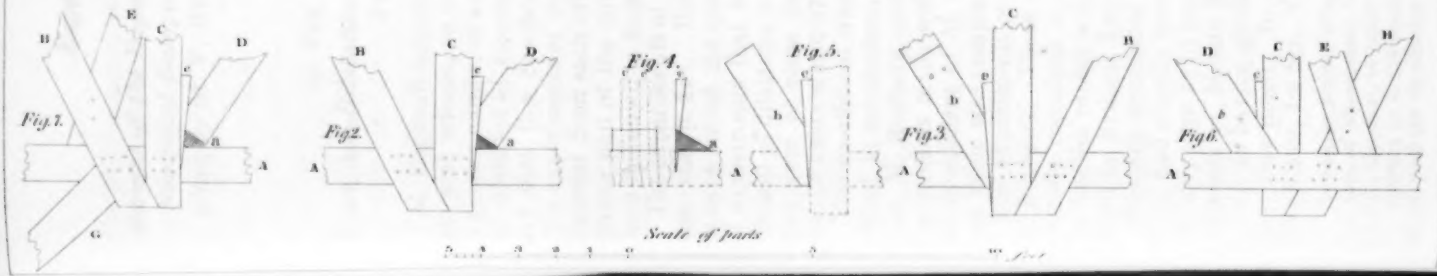

Scale of parts

5 4 3 2 1 0 5 10 feet

Account of the Experiments to determine the Principal Laws and Numerical Data, which enter into the Calculation of Steam Engines, by M. V. REGNAULT.

(Continued from page 141.)

FIRST MEMOIR.

ON THE DILATATION OF ELASTIC FLUIDS.

PART 1.—*Dilatation of Atmospheric Air, under the ordinary Pressure of the Atmosphere.*

M. Regnault commences his memoir, by remarking that there is, in physical science, no numerical element which has been submitted to a greater number of experimental determinations than the co-efficient of dilatation of atmospheric air, and that nevertheless we cannot yet say that this co-efficient is known to us with sufficient precision. The experiments of the elder physical philosophers, gave numbers so different from each other that no use can be made of them. The greater part of the circumstances which influenced the phenomenon were unknown to them.

The experiments of M. Gay Lussac, (Annales de Chimie, 1st Series, tom. xliii, p. 137. Biot. Traitè de Physique, tom. i, p. 182,) seemed to have settled the question finally. He showed by a great number of experiments that between 0° and 100° (32° to 212° Fahr.) the co-efficient of dilatation was the same for all gases, and for vapors, when they were at some distance from their point of condensation, and that its value was 0·375.*

This co-efficient was adopted by all physical philosophers, and em ployed in calculations, until in these latter years a Swedish philosopher, M. Rudberg, cast a doubt upon its exactness. By a series of experiments made with care, M. Rudberg endeavored to show that the co-efficient of M. Gay Lussac was much too large, and that its true value was comprehended between 0·364 and 0·365.

The experiments of M. Rudberg are then described at length, by M. Regnault. These experiments were originally published in two memoirs contained in Poggendorff's Annals, vols. xli and xliv, and the English reader will find them in the valuable Scientific Memoirs, edited by Richard Taylor, vol. i, pages 507 and 514.

Rudberg terminates his second memoir by an important remark, which had already been made in 1803, by Gilbert, (Gilbert's Annals, vol. xiv, page 267,) but had been entirely forgotten, viz: that the experiments of Messrs. Dalton and Gay Lussac, which had been regarded as having given almost identical results, differed, on the contrary, very much. In fact, in the memoir of Dalton, (Memoirs Soc. Manchester, 1st Ser., Vol. v, Part 2, p. 598,) he says:

*The results arrived at by Mr. Dalton, about the same time, (Memoirs Lit. and Phil. Soc. of Manchester, 1st Ser., Vol. v, Part 2, p. 598,) appeared to give a co-efficient, identical, or nearly so, with that of Gay Lussac, (0·3726,) and confirmed his assertion as to the equal dilatation of different gases, so that Mr. Dalton himself adopted the co-efficient found by M. Gay Lussac.

"I have repeatedly found that 1000 parts of common air, of the temperature 55°, and common pressure, expand to 1321 parts of the thermometer; to which, adding 4 parts for the corresponding expansion of glass, we have 325 parts increase, upon 1000 from 55° to 212°, or for 157 of the thermometer scale *(Fahrenheit)*." It is evident that the volume of air here assumed as the unit, is that of air at 55° Fahr., or 12·78 cent. If, on the contrary, we take for unit the volume of air at 0° (32° Fahr.), and put the dilatation between 0° and 100° $=100\alpha$, the results of Dalton give

$$1+12{\cdot}78\alpha : 1+100\alpha :: 1000 : 1325;$$ whence $100\alpha=0{\cdot}392$.

This, then, is Dalton's true result. In truth, Dalton himself does not appear to have observed the error which had slipped into his calculations, for he says in his new system of chemical philosophy:—"The volume of air, according to the experiments of M. Gay Lussac and Minè, being 1000 at 32° Fahr., becomes 1376 at 212° Fahr.

In a note M. Regnault notices a series of experiments upon the same subject, made about the same time with his own, by Prof. Magnus of Berlin. An extract from Prof. Magnus' memoir will be found in the Annales de Chimie et de Physique, 3d Ser. tom. iv, page 330; and a second memoir upon the same subject, tom. vi, p. 353.

M. Regnault then proceeds to give his own method of experimenting, and the details of his experiments.

These methods were five in number. In the first four, the dilatation of the air was deduced from the observed changes in its elastic force at the temperatures of 0° and 100° cent., assuming as true the law of Mariotte, that the elastic force of a gas varies inversely as its volume, when the temperature remains the same. The fifth method was an attempt to measure directly the augmentation of volume due to the change of temperature.

The first method was similar to that used by Rudberg, in his first series of experiments, and by Dulong and Petit, in their comparison of mercurial and air thermometers.

The apparatus consisted of a glass cylindrical reservoir, from 25 to 30 millimetres in diameter, and about 110 millimetres long, containing from 800 to 1000 grammes of mercury. To this was soldered a capillary stem, of which the diameter varied in the different experiments, from ½ to 2 millimetres. This was bent at right angles, at some distance above the reservoir, and drawn out to a fine point. The reservoir and the greater part of the stem were immersed in a vessel of water boiling under the usual atmospheric pressure, and filled with perfectly dry air, by exhausting it from 25 to 30 times, by means of a small pump, and re-filling it each time with air which had passed through two tubes, each one metre in length, filled with pumice stone, saturated with concentrated sulphuric acid. This being done, the apparatus was suffered to stand from half an hour to an hour, the water being maintained in full ebullition, the end of the capillary stem was then closed by the blow-pipe, and the height of the barometer noted. The reservoir, with its stem, was then inverted upon a stand, so that the point of the stem dipped to some distance in a cup of mercury, the point was broken off under the mercury,

and the reservoir surrounded with pounded ice, and left in this condition for an hour or more, until the whole of the air (now contracted so as to fill only a portion of the reservoir) was reduced to the temperature 0°. The end of the stem was then again closed by a little wax, the barometer again noted, the position of the surface of the mercury in the cup marked by a point adjusted by a screw—the cup removed, and the reservoir and its contents suffered to take the temperature of the surrounding air. The height of the mercurial column above the level of the mercury in the cup, was then measured by the cathetometer. The reservoir and its contents were then weighed, entirely filled with mercury, first boiled to free it from air and moisture, the point again immersed in mercury, and the reservoir surrounded with ice. At the end of one or two hours, when it was satisfactorily ascertained that the whole apparatus had taken the temperature 0°, the ice was removed, the mercury which was discharged by the rise of temperature, was received in a capsule, and the apparatus placed in a boiler, as at first, and brought to 100°. The mercury expelled was collected in the capsule, and the height of the barometer at the moment of ebullition noted. By this means, all the data necessary to calculate both the dilatation of the air, and that of the glass vessel which contained it, were given.

In performing these experiments, M. Regnault observed a serious cause of error. When the point of the stem was broken under the mercury, he observed that a small quantity of air leaked into the reservoir, even when the point was plunged to the depth of $\frac{1}{10}$ metre under the mercury. This air was a portion of that which remained in contact with the glass tube, which not being wetted by the mercury, allowed, as it were, a tube of air from the point to the surface. This difficulty was obviated by attaching to the glass stem, plates of well cleaned brass, to which the mercury adhered, and thus the entrance of the air was prevented. In addition to this, a layer of sulphuric acid was sometimes poured upon the surface of the mercury, before the point was broken, and was carefully removed before the point was again closed. Equal care was taken to prevent the air enfilming the pincers used to break the point, from getting access to the interior. In this method fourteen experiments were tried, the mean of which gives for the volume of 1000 measures of air, at the temperature of 0°, when heated to 100°, 1·36623.

The highest number obtained in any experiment, was	1·36689
The lowest " " " " "	1·36549
The difference is	0·00140

or about $\frac{1}{976}$ of the mean.

The lowest number was above the mean result obtained by Rudberg. M. Regnault believes that this may probably be due to the phenomenon of the entrance of the air upon breaking the point having taken place in the experiments of the Swedish Professor, and he remarks that the error would be greater in proportion as the quantity of air operated on was less. He also states that he believes that the first experiments of his own series were affected by this phenomenon,

and as an evidence of this states, that from the moment that he succeeded in preventing it entirely, no experiment gave a number below 1·3659.

The second series of experiments was tried with an apparatus differing but little from the one just described. The reservoir was a glass globe of from 350 to 400 cubic centimetres, soldered to a thermometer stem, about 38 centimetres long; upon this thermometer tube was soldered, at the distance of 11 centimetres from the bulb, a piece of tube very regular in its diameter, about 50 millimetres long, and of a diameter sufficiently large to present but feeble capillary action. The thermometer tube was bent at right angles, and drawn out to a point. The first operation was to gauge the apparatus carefully, and to ascertain its co-efficient of dilatation. This was done by filling it with mercury at the temperature 0°, then submitting it to a temperature of 100°, collecting the mercury expelled, and weighing this, and the quantity which remained in the bulb.

The dilatation of the air was then determined very much as before. Eighteen experiments were tried in this way, the mean of all of which was 1·36633; the maximum, 1·36708; minimum, 1·36585; the difference, 0·00123, or $\frac{1}{1111}$ of the mean.

The third series of experiments was performed with an apparatus imitated from that described by Rudberg, in his second memoir. Upon a shelf within a copper alembic, the cover of which is firmly fixed upon an appropriate support, is placed a glass cylindrical reservoir, 35 millimetres in diameter and 170 millimetres long; to its upper extremity is soldered a thermometer tube, which passes through a tubulure in the cover, and bending twice at right angles, is soldered to a larger tube, which dips down into a cistern of mercury, passing air-tight through a tubulure in its cover. On the same shelf is placed a precisely similar reservoir, terminating in a straight thermometer tube, which passes through another tubulure in the cover, and this apparatus being properly filled with mercury, furnishes a delicate thermometer for noting the temperatures in the alembic. The mercurial cistern is furnished, in its lower part, with a piston, movable by a screw. Through a second tubulure in the cover of the cistern, passes a straight gauge tube, open above, and dipping into the mercury below, and of the same diameter as the tube which terminates the thermometer stem. The capacity of this apparatus having been gauged, and the co-efficient of dilatation determined by a previous experiment, the reservoir is filled with dry air, and the alembic filled with ice, so as to reduce the temperature to 0°; the piston in the mercurial cistern is then raised or lowered, until the mercury in the tube communicating with the reservoir, stands exactly at a mark previously made upon it, and the difference between this point and the top of the column of mercury in the gauge tube, is measured. The ice is then removed from the alembic, and replaced by water, which is boiled, and the temperature of the reservoir being thus brought to 100°; the piston is again adjusted, so as to bring the mercury to the same height as before, in the tube communicating with the reservoir, and the differences of its height in this tube and the guage tube again

read. These two readings of course give the elastic force of the air at these temperatures, and from these the co-efficient of dilatation deduced. The experiments tried with this apparatus, give a mean 1·36679 — the difference between the minimum, 1·36747, and the maximum, 1·36812, being $\frac{1}{1012.5}$ of the mean. M. Regnault does not believe this method susceptible of the same accuracy as the other, on account of the irregular action of capillarity in the tubes, although purposely taken of equal diameters. He also remarks that the results obtained by him are larger than those got by Rudberg, from a somewhat similar apparatus, which he believes may be attributed to the latter having made his mark upon a capillary tube, and to his neglecting the small quantity of air contained in the thermometer tube, which is not heated to 100°. As however, unfortunately, M. Rudberg has not stated the dimensions of his apparatus, it cannot be ascertained what influence this had upon his results.

(To be Continued.)

On Ornamental Art as applied to Ancient and Modern Bookbinding. Read by Mr. J. Cundall, *before the Society of Arts, London, November* 10, 1847.

The author commenced by stating that the earliest records of bookbinding prove that the art has been practised for nearly 2000 years; previous to which time, books were written on scrolls of parchment. Some inventive genius, however, to whom the Athenians erected a statue, at length found out a means of binding books with glue; the rolls of vellum, &c., were cut into sheets of two and four leaves, and were then stitched somewhat as at the present day. Then came the necessity for a covering. The first book-covers appear to have been made of wood, probably merely plain oaken boards, which were afterwards succeeded by valuable carved oak bindings; these were followed by boards covered with vellum or leather, and specimens of such of great antiquity still exist. The Romans carried the art of bookbinding to considerable perfection, and some of their public officers had books called "Diptycks," in which their acts were written. An old writer says that about the Christian era, the books of the Romans were covered with red, yellow, green, and purple leather, and decorated with silver and gold. In the 13th century some of the gospels, missals, and other service books for the use of the Greek and Roman churches, were covered in gold and silver; some were also enamelled and enriched with precious stones and pearls of great value. In the 15th century, when art was universal, such men as Albert Durer, Raffaelle, and Guillo Romano, decorated books. The use of calf and morocco binding seems to have followed the introduction of printing, and there are many printed books bound in calf with oaken boards about the 15th and beginning of the 16th centuries; these are mostly stamped with gold and blud tools: the earliest of these tools generally represent figures, such as Christ, St. Paul, coats of arms, &c., according to the contents of the book. In the reign of Henry VIII.,

about 1538, Grafton, the printer, undertook to print the Great Bible, for which purpose he went to Paris, there not being sufficient men or types in England; he had not, however, proceeded far when he was stopped in the progress of this "heretical book," upon which he returned to England, bringing with him presses, type, printers, and bookbinders, and finished the work in 1539. Henry VIII. had many books bound in velvet, with gold bosses and ornaments; and in his reign the stamping of tools in gold appears to have been introduced. In the reign of Elizabeth, some exquisite bindings were done by embroidery, the queen herself working the covers with gold and silver thread, spangles, &c. Count Grolier seems to have been a great patron of the art on the continent, and all his books were bound in smooth morocco or calf ornamented with gold. The style of the books of Maioli was very similar to that of Grolier, or those of Diana of Poictiers, the specimens done for her being among the finest ever produced, and were no doubt designed by Petit Bernard. Roger Paine was the first Englishman who produced a really good binding, and some of his best works, such as French romances, were powdered with the fleur-de-lis. His books on chivalry had suitable ornaments; on poetical works he used a simple lyre, and carried the emblematical style of binding as far as emblems ought to be used. The following bill of his for binding a work is a curiosity, and shows how moderately he charged:—

"Vaneria prodium Rusticum, Parisiis, MDCCLXXIV.

"Bound in the very best manner in the finest green morocco, the back lined with red morocco. Fine drawing paper and very neat morocco joints inside. There was a few leaves stained at the foredge, which is washed and cleaned. 0 0 6

"The subject of the book being 'Rusticum,' I have ventured to put the Vine Wreath on it, I hope I have not bound it in too rich a manner for the book. It takes up a great deal of time to do these Vine Wreaths; I guess within time I am certain of measuring and working the different and various small tools required to fill up the Vine Wreath, that it takes very near 3 days' work in finishing the two sides only of the book—but I wished to do my best for the work, and at the same time I cannot expect to charge a full and proper price for the work; and hope that the price will not only be found reasonable but cheap. 0 18 0

Civ. Eng. & Arch. Jour.

Note on the Action of a Solution of Caustic Soda upon a Stoneware Jar, by Mr. TRENHAM REEKS.

Having been puzzled in the analyses of some bronzes and iron ores, with the presence of an excessive quantity of alumina, I was induced to examine the reagents employed, and found that this excess originated in the soda, which had for some time been standing in an earthen-

ware jar. I send a piece of this jar, which exhibits a thick coating, nearly all composed of silica, the alumina having been dissolved out by the soda. Chem. Soc. Mem.

Experiments on Crystalization under Extreme Pressure. By W. S. Ward.

This was merely a statement that a number of experiments had been made since the last meeting of the Association, with a view of determining if a speculation then thrown out was correct. Common salt, muriate of ammonia and other salts were exposed, in solution, to a pressure of 100 atmospheres; but no difference in their crystalizable powers were apparent. It was therefore proved, that under a pressure equal to that found in the depths of the Mediterranean no crystalization from pressure would take place. London Athenæum.

BIBLIOGRAPHICAL NOTICE.

Report of the Superintendent of the Coast Survey, showing the progress of the work during the year ending October, 1847.

This work, commenced many years ago by our government, and prosecuted since then with greater or less energy, is one which, whether we consider its importance to our commercial interests and means of defence from aggression, or the greatness of the undertaking, and its influence upon our national reputation for science and skill, ought to attract the notice of every one of our citizens. Yet, until the appointment of the present superintendent, the existence of such a survey was scarcely known, and even yet we fear that its great interest and importance have not received the attention which they deserve. We therefore desire to devote a short space of our Journal to call the attention of our readers to this great work, not only on account of its intimate bearing upon the pecuniary interests of the community, but because, from the vastness of the design, and the difficulties of its execution, as well as from the admirable skill with which it has been heretofore conducted, it is an honor to our country, and entitles us to take rank, in our contributions to useful human knowledge, with our sisters of earlier civilization; an object of ambition at least as honorable as that of rivalling them in their military achievements.

The object of the Coast Survey, is to procure an accurate chart of our extended and dangerous sea-coast, in which every prominent ob-

ject, natural or artificial, visible from a vessel approaching the land, and every change in the depth of the water, the character of the bottom, and the set and force of the ocean currents shall be so clearly and precisely delineated, that the mariner may be enabled easily to recognize his position upon the coast, be fully warned of the dangers which lie in his path, notified of the harbors of safety which lie open to him, and instructed how to enter safely the port of his destination. This is the first and great certain utility of the proposed survey; but when was the exertion of human science and skill useful but in one direction? It enables the proper authorities, in case the flag of a foreign nation shall ever again bring a hostile message to our shores, to foresee the dangers of attack, and to combine a consistent system of defence; and what is far better, the knowledge of this additional element of strength, and the closer knitting of the great bond of friendly communion, by the diminished risk of ocean communications, adds an element of incalculable power to the influences which promote peace. And moreover, conducted as it has been heretofore, with the spirit of broad science and profound investigation, it must add materially to our knowledge of the phenomena of the ocean, and by generalizations from its facts improve the art of navigation, and cause the mariner in the most remote regions of the sea, to feel the beneficial effects of the survey of our coast.

But to insure such important blessings to numbers of our race, is not an easy matter. It is no common map which is to furnish the seaman with a secure guide; and it requires no common resources of knowledge, patience, and energy to overcome the obstacles, and fix with absolute accuracy, the position of each head-land upon our coast, and of every rock and sand-pit which lurks under the waters of the adjacent ocean. It requires no ordinary talents to conduct sucessfully, even a topographical survey upon land, such, for instance, as that which the State of Massachusetts has recently furnished, as a pattern for her sister States hereafter, when they shall see the importance of substituting maps of their territory, for the fancy sketches of imaginary mountains and impossible rivers which now pass under this name; but when there is added the difficulties of accurate hydrography, the determination of the forms and directions of ridges of rock or mud which lie invisible beneath the surface of the sea, it may be easily conceived that a vast expenditure of labor is required, and absolutely inexhaustible resources of knowledge.

To execute such a survey, then, the first thing to be done is to fix with extreme accuracy, a number of convenient points, determining their distances apart, and their relative positions. To do this with the necessary precision, by direct measurement from one point to another, would be impossible, and if possible would require centuries for the completion of the work; recourse must therefore be had to the principles of trigonometry; and a single base-line conveniently selected, and of some length, (say ten miles,) being once accurately measured, and its position in relation to the meridian being carefully determined, the angles of position of any number of points, from the extremities of this base, may be observed, and we shall then have all the data necessary

for a calculation by which their relative positions and distances may be found with precision limited only by the correctness of the observations. The distance between any two of these points being thus ascertained, will furnish us with a new base, from which we may proceed, as before, to the determination of new points, and thus the whole tract to be surveyed is covered with a series of triangles, the positions of whose vertices are known. This operation is called the primary triangulation. The length of the sides of these triangles, will of course vary with circumstances, and will principally depend upon the nature of the country. In a mountainous region, they may be from fifty to seventy miles, while in a flat tract it may be impossible to obtain a greater length than twelve or fifteen. The space within these triangles is then, by a second operation, subdivided into other and smaller triangles, and these again are similarly subdivided; and thus the whole tract becomes covered with a net-work of lines well determined both in length and direction, the areas within which are sufficiently small to be considered as planes, and the minute features of the topography may then be put in by the use of the plane-table, which is in principle nothing but a drawing-board and ruler, provided with sights, and so mounted that it may be used upon the field. The outline of the coast being accurately known, the result of the soundings within sight of shore can be easily connected with the land-survey—and the position of shoals, breakers, and islands, out of sight of land, can be determined by the usual observations for fixing their actual position upon the surface of the earth.

The work can be verified at any time and place, by actual measurement of any straight lines whose length can be calculated from the triangulation, and it is truly wonderful to see how near these independent determinations agree, when the operations have extended hundreds of miles from the original point of beginning.

It is easy thus to give a general idea of the theory of a trigonometrical survey—but it is impossible to convey to general readers, an idea of the immense and ever-recurring difficulties which oppose the actual prosecution of such a work, still less of the resources of inventive genius, profound scientific knowledge, acute perception, patience, and energy which are required to overcome them, and bring such a work to a successful issue. The whole result rests upon the accuracy of the primary triangulation, and there is perhaps no problem ever solved by the human intellect, upon which all the resources of physical science are so completely exhausted as upon this, and upon the accompanying astronomical observations, by which the absolute positions of the points of the survey upon the surface of the earth are determined, the geodesic operations checked, and the surveys of one country placed in connection with those of others in other quarters of the globe.

Our Coast Survey was well begun and excellently conducted by the late lamented Mr. Hassler. The present superintendent has introduced into it some new features, to two of which, as we consider them of immense practical importance, we propose briefly to allude.

The first of these was so to arrange the organization of his survey-

ing parties, so as to make the work consist, in the first instance, of a number of independent surveys, which, radiating from distinct centres, should, by gradual production, meet each other, and, uniting, form the one great survey in which the work is to result. Such a method of proceeding applies to the work the most severe test of its accuracy which could be devised, for it requires the measurement of a number of base-lines on various parts of the coast, upon each of which rests appropriate triangulation, at the outer verge of which, are numerous points common to two systems, in the determination of which they must accurately coincide; and as this coincidence can only be ascertained by means of the calculations which are performed in the general office at Washington, all trimming and bending *(tech. cooking)* of observations to meet the purpose is impossible, and if any error exist it must be seen. It requires, therefore, no little confidence on the part of the superintendent, in the work of himself and his assistants, to permit the proposition of so bold a plan, the vast importance of which is however easily seen, since it allows all the important harbors upon our extended coast to enjoy at once the benefits of the survey, and thus prevents immense annual losses of lives and merchandize now jeoparded upon our almost unknown seas, shortens the time necessary for the completion of the entire work, and, as the superintendent has shown, (not only on paper, but in practice,) is productive of great economy in the expenditures. This feature has now, we believe, become the settled policy of the government, and under it the operations of the survey in 1844 embraced nine states; in 1845, thirteen; in 1846, fifteen; and in 1847, eighteen states.

The second improved feature which has been introduced by Mr. Bache into the survey, consists in the publication of the maps containing the results of the survey, as fast as the work is completed. In this way the harbor of New York, the approaches of Philadelphia, and several detached harbors upon Long Island Sound and the Chesapeake have been published, and the maps, upon a convenient scale, exposed for sale at a price so low as to allow every one to possess himself of a copy. The vast importance of this feature is two fold. In the first place, as in the former case, it prevents the great loss of property which is every year taking place, and does not require the master of a vessel trading to Boston or New York to wait for an authentic chart, until every sandy rock and brackish lagoon upon the shores of New Jersey and Texas have been surveyed—and in the second place, by shewing the public the results of the survey, it keeps alive their interest in the work, and disposes them favorably towards the undertaking. In reference to the amount of saving of property which is daily accruing from the publication of the results of the survey, let our readers consult the reports and their appendices, for the opinions of our merchants and insurance offices.

The want of space compels us to close this hasty notice for the present, but we propose in a future number to return to the subject, and give to our readers some extracts from the reports to illustrate our remarks, and demonstrate our fundamental proposition, that

both from the magnitude and importance of the undertaking, and the admirable manner in which it is conducted, the United States Coast Survey will prove honorable to us as a nation, and useful to mankind at large.

Let us hope then that the suggestion of Mr. Bache, at the close of his last report, will not only be adopted but extended, and that our government will not only order the Pacific Coast to be similarly surveyed, but that it will extend the plan so as to include the lakes and great rivers, and finally, to embrace a complete topographical survey of our whole territory. F.

FRANKLIN INSTITUTE.

Monthly Meeting, February 17, 1848. DR. R. M. PATTERSON, *Presiding.*

The following donations were announced :—

From Prof. A. D. Bache, Washington, D. C.—
Congressional document, containing the Report of the Superintendent of the Coast Survey, showing the progress of the work.—1847.

From the Central Railroad and Banking Company, of Georgia—
Thirteenth Report of the President and Engineer, and the proceedings of the meeting of the Stockholders, December, 1847.

From the Mine Hill and Schuylkill Haven Railroad Company—
Their Annual Report for 1847.

From the Pennsylvania Institution for the Deaf and Dumb—
Their Annual Report for 1847.

From the Academy of Natural Sciences, Philadelphia—
The Bulletin of their proceedings, Vol. 3, No. 12.

From Mr. J. S. Lippincott, Philadelphia—
A work entitled, the Mineral Region of Lake Superior, comprising its early history, &c. By J. Houghton, Jr., 1846.

From Messrs. Lea & Blanchard, Philadelphia—
A work entitled, Principles of Physics and Meteorology. By J. Muller—American edition, 1848.

From Dr. A. M. Comstock, Philadelphia—
A copy of the New Testament, printed in his Phonetic characters, 1848.

From Solomon W. Roberts, Esq., Harrisburg, Pennsylvania—
Legislative Documents and the Daily Legislative Record.

From T. H. Forsyth, Esq., Harrisburg, Pennsylvania—
Legislative Documents and the Bills of the Senate and House of Representatives.

From Prof. R. S. McCulloh, Philadelphia—
A Congressional Document, containing the report of Scientific investigations relative to the Chemical nature of saccharine substances, and the art of manufacturing Sugar; made under the directions of Professor A. D. Bache, by Prof. R. S. McCulloh, 1847.

The committee on Mr. Elliot Cresson's proposition to found a gold

medal, reported recommending the following resolution, which was adopted:

Resolved, That the Committee on Exhibitions be authorized to carry out the intention of Elliot Cresson, Esq., in regard to the gold medal established by him, and to receive from the Trustees designated by him, such directions for the preparations of the dies, and the striking and award of the medal, as the trust created may require.

Eight candidates for membership were proposed.

The following candidates, proposed at the last meeting, were elected members:

Alex. Burbeck, Jr.; Wm. Haywood Drayton; Harris S. Louderback; William Swain; Franklin Stewart; David S. Siner; Robert Warnock; Henry H. Wilson; Joseph D. Williamson; Charles C. Watson, Jr.

The following gentlemen were appointed on standing Committees:

Committee on Library—Messrs. J. Allen, F. A. Brégy, W. J. Levering, J. P. Parke, D. Rhoads, W. Roberts, J. D. Sheble, S. D. Steele, A. Wood, and G. J. Zeigler.

Committee on Arts and Manufacturers—J. C. Booth, W. F. Coggins, J. C. Copper, C. M. Ghrisky, W. Harris, A. L. Kennedy, G. L. Thomas, F. A. Trego, W. P. Troth, and I. S. Williams.

Committee on Meetings—C. B. Foster, E. Greble, B. B. Gumpert, W. Hartel, W. R. Johnson, W. E. Morris, F. Peale, J. B. Reynolds, S. W. Roberts, and G W. Smith.

Committee on Cabinet of Models—J. Agnew, H. B. M. Berkinbine, B. M. Feltwell, H. Huber, Jr., W. H. Loper, J. V. Merrick, T. S. Stewart, T. U. Walter, G. Weigand, and T. F. Williams.

Committee on Exhibitions—J. E. Addicks, J. Agnew, J. C. Cresson, J. P. Ellis, O. Evans, T. Fletcher, B. Huckel, S. W. Roberts, C. A. Walborn, and J. Weigand.

Committee on Cabinet of Minerals—C. F. Beck, J. C. Booth, M. H. Boyé, J. F. Frazer, E. Greble, R. E. Griffith, W. Pettit, R. C. Taylor, A. W. Thompson, and C. B. Trego.

Committee on Meteorology—M. T. W. Chandler, J. P. Ellis, G. Emerson, O. Evans, R. Frazer, B. Huckel, J. S. Lippincott, R. P. Thomas, C. B. Trego, and F. A. Trego.

Communications on subjects connected with science and the arts being called for,

Mr. G. W. Smith called the attention of the members to specimens of various articles made of gutta percha, especially to a driving belt which had been for some time in use in the machine shop of M. W. Baldwin; he asked especial attention to the neatness and strength of the joint made by simple superposition of the two ends of the belt, with pressure, when heated to the temperature of 180°. He also exhibited some specimens of sheets of the substance intended for use in book binding for which it possesses certain advantages; these sheets were beautifully figured in imitation of watered silks, &c. He also noticed the application of the substance to the soles of shoes, and stated that it possessed great durability, and the impermeability to water which distinguishes caoutchouc, and has the additional advan-

tage of not becoming slippery upon wet pavements. Shoes prepared with this material can be procured at the store of Mr. Thornley, in Chesnut street above Fourth.

Mr. G. W. Smith also submitted to the meeting, a model of a new coupling joint for steam (and other) pipes—patented by Messrs West & Thomson. The ends of the pipes to be joined are provided with beveled flanges, between which the patentees prefer to place a piece of prepared caoutchouc or other elastic substance, although this is not absolutely necessary. The flanges are surrounded by a grooved ring, cast in three pieces, and joined by screws, passing from one segment to the other; as these screws are tightened the flanges are compressed, and the joint thus made perfectly steam tight.

Mr. C. B. Foster, Dentist, removed three teeth from the mouth of a gentleman while under the influence of chloroform; upon his recovery from its effects, the gentleman stated that he had felt no pain during the operation.

Dr. Comstock then addressed the meeting, and explained the principles of the formation of his phonetic alphabet, which differed from ordinary alphabets in having a symbol for every distinct sound, of which there are thirty-eight in the English language, while there are but twenty-six letters to represent them. Dr. C. proceeded to enumerate these sounds, and stated that wherever the alphabet of any language had a symbol appropriated exclusively to express any particular definite sound, that symbol had been adopted by him; wherever this was not the case, a symbol had been invented for that sound. When the sound could be considered as a compound, the symbol was so arranged as to present those of the elementary sounds which enter into its composition. Dr. C. explained the advantages which he conceived his system to possess over the ordinary methods of writing the English language.

Mr. Pantoleon expressed his concurrence in the opinions expressed by Dr. Comstock, and proceeded to illustrate the applicability of the phonetic system to languages other than the English. He stated that there were fifty-four distinct simple sounds possible, of which twelve were not used in any language. There were therefore but few additional symbols necessary to be introduced in order to extend the system devised by Dr. Comstock to the expression of every other language. He illustrated his positions by examples from the Turkish languages, and urged the importance of its adoption by Americans as a means of rendering their language easier of acquisition both by children and foreigners.

Mr. Dyer, of New York, was then introduced to the meeting, and proceeded to unfold the principles of the art of Phonography, or writing according to sound. He explained what is meant by writing by sound. The word *awe*, he said is composed of *one simple vowel sound*, as any person would readily perceive upon enunciating it with distinctness. The word *ought* is composed of *two* sounds; *sought*, of *three* sounds, as will also be readily perceived. In short, *all the words in the English language* are formed by combining variously, about *forty simple sounds.* Now Phonography furnishes